ARCHIVES

OF

USEFUL KNOWLEDGE.

VOL. III. JULY, 1812. No. 1.

PAPERS ON COMMERCE.

New Method proposed for measuring a Ship's Rate of Sailing.

By JAMES BURNEY, *Esq.**

A LINE towing astern of a vessel, which is passing through the water, will pull against her head-way. As the ship's way increases, the pull of the line will increase; and *vice versa*. If this, with a proper scope of line, (about 25 fathoms may probably be sufficient), shall be found to be a regulated quantity of pull corresponding in the same manner at all times to the rate of sailing, it will answer the purpose of a log. Many experiments have been made upon the same principle; but the most plain and easy one, of towing a measured length of line, has escaped trial; though less liable to give erroneous or variable results than any which can be made near a ship. By it, the rate of sailing may be obtained either constantly or occasionally, and can be taken with ease by one person: in which respect it would have great advantage over the common log, the use of which requires three persons.

By a trial made in a boat with about 20 fathoms of line, rather larger than log line, towing astern and fastened to a spring

* From Nicholson's Philosophical Journal, Vol. 24, p. 57. London, 1809.

steelyard, the strength of the pull was found to vary with the rate of sailing, which, however, was not ascertained by measurement; but by estimation, the boat's rate of sailing during the trial varied between 2¼ knots and 5 knots per hour, and the pull of the line upon the steelyards was observed to vary from 2 lbs. to 5½ lbs.; increasing and decreasing with the velocity. So great a variation in the strength of the pull gives all the advantage which can be desired for forming a scale, and will allow of the experiment being made with a smaller line.

If the proposed length of line is passed through a pulley so as to go clear out at the stern port or cabin window, and the inner end is fastened to a loose chain, of weight adapted to the purpose on the deck under the pulley; or to a number of small weights made consecutive by short intervals of line, the chain or weights will be drawn up more or less according to the ship's velocity. By a few comparisons of the quantity of weight raised from the deck with the rate of sailing, a scale may be marked.

In an improved state of the experiment, instead of using weights or a pulley, the inner end of the line (coming direct from the water) can be fastened to a spring, and communicate with an index that shall express the rate of sailing.

This machine (if so plain a contrivance deserve that name) may be put on constant duty, or dropped occasionally to ascertain the rate.

Objections which occur, are,

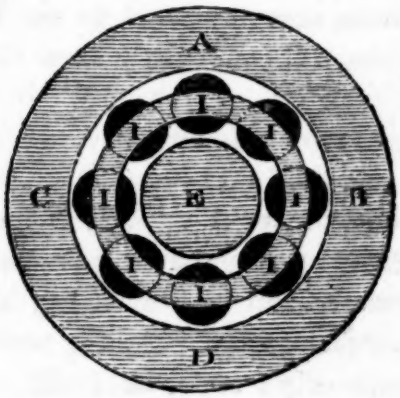
1st. The line being liable to contraction or expansion as the temperature of the water varies. But it is scarcely to be supposed, that the greatest contraction or expansion of line from its mean state (after it has been properly stretched and seasoned) will occasion an alteration of a hundredth part in the force of the pull.

2d. That in a fresh wind the part of the line between the ship and the surface of the water, will be liable to some additional pull from being exposed to the wind. To this inconvenience, the log line in the common way of heaving the log is likewise exposed when the wind is much aft. In either case, when the ship is

not right before the wind, the remedy is the same: which is, to throw the log or the line over from before the lee gangway, and to give a few fathoms more of stray line; for which, however, in the new method proposed, it would be necessary to apply a correction, the quantity of which may be accurately ascertained.

3d. The motion of a ship in pitching. But this is not to be regarded as an objection; for the rate of sailing is to be estimated only, by what the experiment shows when the ship is going steadily; in the same manner as in taking bearings, if the compass swings, we wait till it is quiet. Whenever the ship goes steadily for ten seconds together, or even five seconds, the pull of the line will be regulated to the average rate of sailing.

GARNETT'S PATENT SHIVES.



A B C D represents a ship's block or pully, of which E is the axis, having equal solid rollers, IIIIII, &c. nearly touching each other; and situated between the axis, and the inside cavity of the block or pully. The rollers are furnished with axles inserted into a brazen circular ring at each end, and are kept separate and parallel, by means of wires fastened to the rings between the rollers, and rivetted to them. The ends of the axis E, are fixed in a block after the usual manner. "By this method indeed, some friction unavoidably takes place betwixt the axles of the rollers and their sockets, in the brass rings, but as the quantity

of friction depends principally on the force by which the rubbing surfaces are pressed upon each other, and as in this case there is but the slight pressure occasioned by those accidental circumstances which would bring the rollers together, the friction must be too trifling to be noticed."*

"The holes too are made rather large, the use of the axles to the rollers being only to prevent their running one against the other; nor does the addition of weights upon the pullies, increase that friction, for the addition of weights upon the pulley will press the rollers harder upon the axis E, but not upon their own axis, as may be easily understood by inspecting the figure."†

This important application of a philosophical principle by Mr. Garnett,‡ formerly of Bristol, England, but now of New Brunswick, (New-Jersey,) has been of the greatest service to navigation, as in a vessel rigged with those blocks, three men are able to do the work of five, with a set of common pulley blocks.

The following facts, communicated to the Editor by Captain Bliss of Philadelphia, will particularly show the power acquired by their use.

In the Delaware, near Chester, in very holding ground, he never was able to raise his best bower anchor, without a purchasing handspike; but the next voyage, having supplied himself with a patent roller for the hawse-hole, he anchored in the same place, as formerly, and in heaving up his anchor without it, he hooked up another anchor weighing 1300 cwt. He added, that with a common ship's crew, he could at any time, when getting under way, have his three topsails set at once after having the patent blocks in his rigging.

These rollers admit of an extensive application to all sorts of circular motion round an axis; and they have been accordingly so prepared by the ingenious patentee. Besides their use in blocks, pulleys, and hawse-holes of ships, they have been applied

* Encyclop. Britan., art. Mechanics.

† Cavallo's Nat. Philos., Vol. 1.

‡ Not *Gamett*, as printed in the Encylop. Britan., art. Mechanics, and in Rees's Cyclop., art. Friction.

to the boxes of carriages. The Editor had them fixed to the axle of a wheel attached to a straw-cutter, and carrying three knives, the power of which is very great, and works so easily, that a boy of 12 years old can turn it, and in a few minutes cut straw enough for mixing with the food of several working horses.

It is to be regretted that the inventor of this useful contrivance, has not taken measures to establish the manufactory in the United States.*

* The following advertisement appeared some months since in the Boston papers:

IMPROVED PATENT IRON SHIVES.

Recommended by the principal Merchants and owners in the town of Plymouth, Massachusetts.

We, the subscribers, having had opportunity, from the repeated trial on board our shipping; do give our decided opinion, that they are both useful, and durable; and do hereby publicly recommend them to the owners of shipping.

BARNABAS HEDGE, JUNR.
WILLIAM DAVIS,
ROBERT ROBERTS,
JOHN CLARK,
ATWOOD DREW,
WILLIAM HOMES,
TRUEMAN BARTLETT,
JOSEPH BARTLETT,
NATHANIEL CARVER.

N. B. These Shives being cast upon a polished Pin, (which is driven out when the Shive cools) the hole acquires a degree of hardness, equal to hardened steel; and being perfectly smooth and straight, the Shive runs light and easy on the pin. They are warranted to last for seven years, and it is believed from the examination of those which have been in use, that they will last much longer, (with proper management) by occasionally rubbing the hole with tallow in the inside. They are not found to wear the shell of the Block, and are more firm and substantial, than any cogg'd Shives whatever; and as the edges of the Shives never crumble in wear, like Lignum Vitæ, they preserve the rigging. The above with turned iron pins, are for sale by Bemis & Eddy, agents for the patentee, No. 12, Long-wharf.

PAPERS ON MANUFACTURES.

ON ROLLING COPPER INTO PLATES.

The following method of rolling Copper into plates, as practised at the extensive works at Taybach, in Wales, is taken from Donavan's Tour through South Wales and Monmouthshire.*

BEFORE the copper is converted into plates or bars, the pig of metal is made red hot, when it is closely beaten together under the hammer, and cut into pieces of the most convenient length for the purpose wanted, by shears moved by a wheel. Again, those pieces are conveyed to the furnace when they become red-hot as at first. One of the pieces is carried at a time to the flatting mill, a machine not much unlike the rolling press of a copper plate printer. The two cylinders are of steel, case-hardened and secured within a frame of iron. A man stands on each side, and while the two cylinders revolve, each in a contrary direction, one of them lifts up the piece of red hot copper with a pair of tongs, and thrusts it between the cylinders, the other man on the opposite side securing it with his tongs as it passes through. This he lifts back again over the upper roller, to the first man, who by the assistance of a strong screw, diminishes the distance between the two cylinders, in order to widen and compress the plate still more; when it is conveyed a second time between them. This screw is turned for the same reason every time before the plate passes between the cylinders, and thus by the most simple process imaginable, the plate is gradually reduced as thin and broad as the workmen may desire.

By means of a similar machine, the copper is wrought into bars instead of plates, of any form or thickness, with equal facility. For the latter purpose, the smooth surface of both the cylinders are alike indented with eight, ten, or more distinct grooves, all which differ from each other in width and depth. The series commences with the largest groove, encircling one end of the cylinder; the next in point of size succeeds, and thus they di-

* Vol. 2, p. 59. London, 1805.

minish gradually to the other extremity of the series, which terminates with the smallest groove. The piece of copper being heated as before to a fiery redness, the workmen force it between the first or largest groove of the adjusted cylinders, where it receives either the round or angulated form of the groove from the compression of both the cylinders, as readily as wax in a common mould. Should it be necessary, the bar is conveyed in like manner progressively through the second, third, or fourth groove, or through the whole series, till it is reduced to the thickness wanted, the length being increased in proportion as the bulk diminishes.

The copper, after receiving its proper form in the flatting mills, and cooling, is of a dusky black, or iron colour, and in order to communicate to it that lively hue which is commonly understood to be the true complexion of this metal, the plate or bar is heated again for the last time in a furnace, and when red hot is plunged into a recess filled with a saline liquor,* where it assumes that colour in a few moments, and being withdrawn, the copper is put aside as being finished for exportation.

METHOD OF TINNING IRON PLATES.†

This manufactory is carried on extensively in Caermathen, in South Wales.

THE iron ore employed in this manufactory is the common argillaceous kind, of South Wales, intermixed with a considerable portion of the Ulverston ore of Lancashire, a rich *hematite*, the latter, which it is deemed necessary to smelt with the other sort, in order to produce a metal of such pliability as the iron plates designed for tinning require.

These ores are reduced to a state of fusion together, by the means of charcoal, a fuel far superior for this purpose to the

* In Aikin's Chemical Dictionary, it is stated, that this fluid is urine. The redness which the copper thus acquires, is considered by the merchant as one mark of the purity of the metal. *Editor.*

† From Donavan's Tour through South Wales, Vol. 2, p. 193.

coke of sea-coal, every impurity in the metal being destroyed, or expelled, by its assistance. The machinery of the smelting work is on the old construction, a large double pair of bellows, worked by a common water wheel, being found to possess all the powers requisite to keep the blast upon the charcoal while the ores are smelting.

After the iron passes through the finery, and is cast in moulds into the form of pigs, it is beaten into long flat bars by the repeated strokes of a ponderous hammer, kept in motion upon the anvil by water; and after this, the bars are cut in pieces of about ten inches in length, by the aid of shears, kept also in motion by the force of the stream. The desevered pieces are next conveyed to a furnace, and when thoroughly heated, are passed between the two massive cylinders of a flatting mill, such as we had before observed at Taybach for reducing the bars of copper into plates. The piece of iron, at the first pressure, extends in length, and width: the adjusting screws are turned still closer, and at the second pressure, the superficial dimensions of the iron are encreased considerably again. When the plate by this process becomes twice the size that plates of tin are in common, it is replaced in the furnace till it assumes a fiery red appearance: the forgemen then withdraw it, and, by a brisk turn with their tongs, folds it directly across the middle, pass it between the cylinders and repeats the operation till the folded plate appears of the same length and breadth as it appeared before it was doubled. Being again heated, bent, and submitted to a comparatively slight compression of the cylinders for a third time, to press the whole together compactly, the edges are clipped with shears, and the plates sixteen in number, are torn asunder, these adhering slightly by their surfaces to each other. A larger number of plates may be made of the same quantity of iron, by folding and passing them between the cylinders again, the thickness of each individually diminishing, of course, in proportion to the greater number of plates into which they are divided.

The trimmings or cuttings from the plates, to reduce them to the size required, are laid aside for the founderies, where they are

converted into bolts for ship building. The plates, when separated, pass through another kind of rolling press, the whole machinery of which is adjusted with such accurate precision, that the slightest wrinkle, or contortion in the plate, will impede their passage between the cylinders, and in that case they are condemned as useless. On the contrary, those which do pass through, appear with a surface perfectly smooth and polished, and are then conveyed to another part of the works where they receive the tinning.—Here the stranger, should the strength of his nerves enable him to endure with the most nauseous stench imaginable, may trace the further progress of this kind of manufacture. Preparatory to tinning, the plates are steeped for a certain length of time in a weak corrosive liquor, or nitrous acid; after which they are taken out, and rubbed, or well scoured and cleansed from the slightest impurity of rust with bran, and are then carried to the crucibles for dipping into the melted tin.—This useful metal is not the product of this country, but is imported hither in blocks of a covenient size, ready purified, and fit for use from the stannaries of Cornwall. The crucibles are of a rectangular form, and pretty deep, to admit the block of tin which is to be melted, and kept in a fluid state by means of a moderately brisk charcoal fire under the crucible. To prevent the calcination of the tin, as well as to prepare the iron plate to receive the tinning kindly, the liquid tin is kept floating in an oil, either that of linseed, or one prepared on purpose from boiling suet. The plate is taken by one corner with a pair of forceps, immersed vertically in the tin, and upon being withdrawn, its dingy surface on both sides is found changed in a moment to a beautiful silvery white. A second, and third dip into the tin, is required for what is called *single tin:* double tin demands a repetition of the process or six times dipping, and in certain cases much more. This is the last process, the plates being afterwards only cleansed with bran, sorted, and packed up in boxes for exportation.

Those works employ a number of persons, girls and women, as well as men: the latter are engaged in the various laborious departments of smelting, milling the plates, and tinning; the fe-

males in preparing them to receive the tin, or in cleansing them afterwards with bran.

Some further particulars may be added from other authorities.*

In many manufactories, the iron plates, before tinning, are cleansed by being immersed in large barrels full of a mixture of rye flour and water, sometimes with verjuice, which by fermentation has become very acid. In Bohemia, the plates remain three times twenty-four hours, in tubs filled with this ascescent mixture, in three different states, after which they are washed, scoured with sand and water, and kept under water till just before they are used, to avoid rusting again.

Attention is to be paid to the heat of the melted tin: if too hot, the plate comes out yellow. The plates are immersed quite wet into the melted tin, passing in their way through the melted suet which covers it. Just before dipping, some water is thrown on the melted suet, which causes a violent ebullition, and makes the surface of the metal quite clear and bright. The plates when tinned, are set up to drain, by which a number of drops of tin collect in small knobs at the lower part. These are taken off by a second immersion into a separate cauldron of tin, but only to the depth of a few inches; by which the drops of tin melt down, and the whole tinning is made more uniform in thickness. They are then cleansed with a rag and saw-dust or bran. About 19½ pounds of tin are required for 300 plates, measuring one foot by nine inches.†

In the manufacture of tin plates on the continent of Europe, a quantity of copper is always added to the tin, but in very small proportion. The exact quantity is regulated by slight circumstances, which only experience can teach. It appears to be in general from $\frac{1}{80}$ or $\frac{1}{120}$ of the tin. The copper prevents the tin from adhering in too great a quantity to the iron, and causes the superfluous part to drain off more freely. Too much copper gives a dull yellow tint.

* Aikin's Chemical Dictionary.

† Encyclop. Arts and Metieres, art. Ferblantier.

ESSAY ON THE NATURE OF SHEEPS' DUNG, AND ON ITS USE IN DYEING COTTON OF A TURKEY RED COLOUR.

By M. J. B. VITALIS, *Professor of Chemistry at Rouen.*

From the Journal de Physique.

THE process which is used at present in the dye-houses, for dyeing cotton of a Turkey red colour, was originally practised in the Levant, and is composed of a series of operations; every one of which requires to be examined by the light afforded by chemistry, if it be wished to be certain of success in this kind of dyeing.

The author being charged by the government to teach the principles of chemistry in respect to its application to the useful arts, it was necessary for him to pay particular attention to that branch of industry which forms the basis of the manufactures and trade of the first manufacturing town in France.

The manufactures at Rouen employ colours both of the bettermost and common sort. By means of certain preliminary preparations there has been given to the latter, a degree of brightness and even solidity hitherto unknown, which was probably the reason that they were admitted to be shown at the exhibition of the year 1806.

The middling and most numerous class of citizens must have goods of a price proportional to their means. The common colours also employ a great number of workmen, and yield a profit which other towns would be ready to seize, if the manufacturers of Rouen should in time despise it.

But it is principally from the bettermost colours, that is to say, those which are dyed in the manner of Turkey red, that that town derives its glory and riches. These colours have opened to industrious manufacturers an immense field of inexhaustible riches. The manufacturer may now enrich his designs with that variety, that happy mixture, that elegant association and harmony of colours which is so agreeable to the sight, and will please the taste of the most delicate connoisseur, and of one the most delicate to be pleased. These are not fugacious and ephe-

meral colours that impose for a moment upon the eye by a false and deceitful brilliancy, but which may be said to vanish as soon as they are produced. Turkey red, and the numerous train of colours that depend upon it, such as cherry red, rose red, voilet, lilac, pullicats of every shade, clove browns, amaranths, &c. are but little acted upon by the most powerful agents, and scarcely yield to the long-continued action of air, light, and soap.

It is to the employment of these colours, that the manufactories of Rouen owe the high degree of reputation which raises them above all ther rivals.

The process of dyeing Turkey red is therefore an object of the highest importance and consideration to them.

A search has therefore been made, as far as was possible, to smooth the difficulties and dissipate the uncertainties that exist in the operations, which cotton destined to receive the Turkey red colour is made to undergo, by applying to each of them the torch of chemistry, and by examining them in the relations they may have with the principles of that science.

The results of the researches on the nature and use of sheeps' dung in the dyeing of Turkey red, are now presented to the Institute. The end of this essay is to settle the action and influence of the dung-vats, which are the first baths that are given to cotton in dyeing it Turkey red.

According to Le Pileur d'Alpigny, in his art of dyeing cotton, neither the dung nor intestinal liquor of sheep are of any utility in fixing the colour; but it is known, says the author, that this kind of excrementitious substances contains a great quantity of volatile alkali in a disengaged state, which has the property of brightening *(roser)* the red.

Felix adopts the same opinion in an essay on the dyeing of the red spun cotton from Greece, and on the trade in it, inserted in the Annales de Chimie, tom. 31, p. 195.

The ideas which the dyers have formed on the nature of the dung baths, are so far removed from any appearance of fact, that it is perfectly needless to mention them. How indeed, for example, is it possible to suppose that dung is only useful because

of the remains of vegetable matters that it still contains, and which, by the small size of its molecules serve to divide the oil that is always mixed along with the dung to form these baths?

On recollecting what the most celebrated authors have written on the nature of animal excrements in general, it was impossible not to conceive some doubts at least respecting the opinion of Le Pileur d'Apligny.

In order to form a precise opinion respecting the use of sheeps' dung in the kind of dyeing here mentioned, it is necessary to pay attention to the mucus liquor which lines the internal parts of the hollow viscera, and of the canals that are open to the air, and communicate from the exterior of the body to the internal parts, as the œsophagus, trachea, intestines, &c.

This mucus, says M. Fourcroy, destined to lubricate the parts just mentioned, to keep up their softness, and the heat of their surface, and to hinder them from becoming dry and stiff, contains a kind of gelatinous albumen, but little inclined to become dry; being deliquescent, scarcely growing thick in the air, and keeping up the suppleness and mobility of the sides of the canals in which it is deposited.

Haller, in his immortal work upon physiology, represents the intestinal liquor as a mixture of bile, pancreatic juice, the residuum of the food, the mucus of the intestinal cryptæ, and a humour separated from the extremities of the arteries. This last liquor is, according to the celebrated Swiss physiologist, the most abundant, and may be looked upon as the real intestinal liquor.

Besides the uses already mentioned, it also serves, according to M. Fourcroy, to destroy the acrimony of the food as well as to dilute and to connect the excrements.

On applying these principles to the intestinal liquor of sheep, it cannot be doubted but that this liquor exists abundantly in the residuum of the digestion of this animal, and that it is to the presence of this liquor in them, that the advantages obtained from dung-baths in dyeing ought to be attributed.

Volatile alkali, therefore, is not present in a disengaged state in sheeps' dung, as Le Pileur d'Apligny pretended.

Macquer observed, a long time ago, that fresh excrements do not yield any ammonia by the first impression of fire, as is done by animal substances which have undergone putrefactive fermentation; from whence it follows that ammonia is not present in recent dung, and that this alkali can only be met with in it when the balance of the original attractions is broken by putrefaction, which produces new attractions to which the formation of the alkaline product is owing.

Experiments have dissipated every doubt on this subject, for from them, it appears that 61.19 grammes* of fresh sheeps' dung, yielded on distillation.

	grammes
Acid and alkaline liquor, . .	48.8
Gaseous fluids, ...	0.58
Concrete and liquid oil, . .	3.91
Charcoal and phosphate of lime, .	7.3
	61.09
Lost, ...	.1
	61.19

It therefore not only appears that ammonia does not exist ready formed in sheeps' dung, but also that it cannot exist in it in a great quantity, as stated by Le Pileur d'Apligny.

So that the properties which are ascribed to the ammonia contained, as it is said, in large quantities in sheeps' dung are as imaginary as the being to which they are ascribed. It therefore becomes necessary to search in some other principle for the cause of the effects produced by baths of sheeps' dung in dyeing Turkey red.

But this principle can be no other than the albumino-gelatinous matter abundantly contained in the excrements of sheep. It is only necessary to pay attention to the manner in which it is used in the dye-houses, in order to be convinced of this.

The dung is first macerated, for a longer or shorter time, in a cold solution of soda, marking about 4° by the hydrometer. The

* A gramme is equal to about 15 1-2 English grains. *Editor.*

intention of this maceration is evidently to bring about the solution of the albumen and gelatine by means of the alkali. Afterwards a certain quantity of this solution, strained through a sieve and diluted with water of soda at 2° hydr. is mixed with fat or mucilaginous olive oil; by which means there is formed a sort of liquid animal soap, with which the cotton is carefully impregnated.

In this preparation, the cotton by combining with the albumen and gelatine, approaches in some degree to the nature of animal substances, which are well known to have a much stronger attraction for colouring matters than vegetable substances have. The combination appears to be favoured by the oily principle which is combined at the same time with the cotton.

It may thus be seen why authors who have written on Turkey red recommend not only the use of dung, but also of the intestinal liquor of sheep, which would be still more advantageous, if it was possible to procure it in sufficient quantity for the use of dyers.

Experience is evidently in favour of the theory just mentioned.

Fresh sheeps' dung was macerated for 4 or 5 days in a ley of soda at 4° hydr.: it was then filtered, and a reddish brown liquid was obtained. The alkali was then got rid of by adding very dilute sulphuric acid, and an abundant light precipitate appeared, and was deposited at the bottom of the vessel, after having occupied for some time the whole bulk of the liquid.

In order to leave no doubt on the nature of this precipitate, it was collected upon a filter, and after being well washed with cold water, it was boiled in a phial with pure water for about an hour, and the reddish yellow liquor was then decanted, into which a solution of tannin being poured, a precipitate was formed that plainly shewed the presence of gelatine.

The albumen, coagulated by the action of caloric, remained at the bottom of the phial in the form of small, soft, and spongy lumps; and if a judgment may be formed from the quantity of undissolved matter in the water, although it was renewed three

or four times, albumen is much more abundant than gelatine in sheeps' dung. It is not far from the truth to say, that the proportion of the albumen is superior to that of the gelatine in the ratio of at least 3 to 1. But particular circumstances have hitherto prevented the exact determination of this point.

In order to remove every doubt on this subject, it was attempted to supply the place of dung-baths by an alkaline solution of white of egg, or albumen, and perfect success was obtained, both with bettermost and common colours. They all acquired much more solidity than when the use of natural or artificial dung-baths was neglected.

This last observation, founded upon reason and experience, completely overturns what Le Pileur d'Apligny advanced, when he said that the dung or the intestinal liquor of sheep are of no use in respect to the fixing of the colour.

The essential principles brought forward in this essay may be reduced to the following.

1°. Sheeps' dung used in dyeing Turkey red does not contain ammonia.

2°. Ammonia has not the property of enlivening (roser) Turkey red.

3°. Sheeps' dung acts only by the albumino-gelatinous matter that it contains; which serves to reduce the cotton to the nature of animal substances, and of course to dispose it to unite more solidly with colouring matters than before.

4°. The dung and intestinal liquor of sheep are very useful for fixing colours in general, and particularly Turkey red.

A TREATISE ON THE ART OF DYEING WOOLLEN CLOTH SCARLET, WITH LAC LAKE.

By WILLIAM MARTIN. *London.* 1812.

The following important treatise, which recently issued from the press, was received by the Editor from an attentive correspondent in London.

HITHERTO *Cochineal* has been the only substance found to produce *Scarlet* in perfection. The colour obtained from *Madder* and the *Woods* scarcely deserves the name, as it fades or changes, in a very short time, to a dusky brick-red; and though that from the insect *Kermes* is more permanent, it will not bear any comparison with the colour produced by cochineal.

But the price of cochineal is so high, that its use is attended with great expense; and vast sums have been expended by the nation in procuring it from foreign countries; the price at this time, in the London market, being from 30*s*. to 35*s*. per lb.

The process I have discovered and brought to great perfection, produces, with lac lake alone, a scarlet colour on wool, equal to that from the finest cochineal, with the important advantage of being more permanent.

It is scarcely necessary for me to remark, that it will be utterly impossible for those who use cochineal, to meet those who employ lac lake in the market.

The only thing required in particular for lac lake, if the experiment is made on a small scale, will be a glazed earthen vessel, in which to make the solution of the colour.

OF LAC LAKE.

Lac lake is the colouring matter of an insect, called by the natives in India, Lacca, or Lácshà, precipitated from its solution in an alkaline lixivium, by a solution of alum.

The sticklac, from which the colouring matter is extracted, is procured chiefly in the uncultivated mountainous parts of Hindostan that border on the Ganges, and it is found in the same situations on the other side of that celebrated river; it is also

said, that a kind, more abounding in colour, is brought from the kingdom of Siam.

The insect that produces the substance from which the colour is obtained, is of the order *Hemiptera* in zoology, and genus *Coccus*, being a species of the same genus as the cochineal: the species of the lac insect is denominated *Coccus Laccæ*; the cochineal species *Coccus Cacti*. The lac insect is produced on the branches of several different kinds of trees and shrubs, among which may be enumerated the Indian fig or Banian tree, the Arabian Buckthorn, and a species of Mimosa, called by the Hindoos, Conda Corinda. Sometime after these insects are produced, in the early part of January, they fix themselves toward the extremities of the succulent young branches in vast numbers, remaining without any movement or appearance of life, whilst a sub-pellucid liquor exudes from their bodies, appearing to glue them to the branch: this liquor accumulates around them, and hardens by degrees, until at length a complete cell is formed for each insect; and the branch, from their numbers, is nearly covered with this hardened substance, which is rather of the nature of wax than gum or resin: so that the name given to it of Gum lac is not the most proper. About the beginning or middle of March the cells are completed, and the insect appears like a small red bag, of an oval form, emarginated at one end, and filled with a beautiful red liquid. In this liquid the eggs are deposited and hatched, the grubs remaining until the red fluid of the mother is exhausted, which happens generally about the month of November. The young insects then pierce a hole in the back of their mother (now reduced to a mere shell, like the exuviæ of a caterpillar), and escape; leaving behind them a membraneous substance like cobweb, with which they had been enveloped.

At the proper season, the natives break off these branches, and carry them to the market for sale; no doubt before the young insects escape, which are probably killed by immersion in hot water; and we receive these branches or twigs here, usually packed in bags, under the name of sticklac: we also receive a

kind that is nearly without colour, but applicable to the same purposes as shellac.

It is not more than four or five years since lac lake was first manufactured at Calcutta, from which place we have received all that has come to this market.

When it is intended to manufacture lac lake, the lac is separated from the branches, procured as fresh from the tree as possible; it is then garbled and powdered: this powder is put into a glazed earthen vessel, and a boiling alkaline lixivium poured on it. The wax melted by the heat remains at the bottom, while the lixivium dissolves and takes up the colour. The coloured solution is then decanted into another similar vessel, and a solution of alum, sufficient to saturate the alkali, poured into it; the colouring matter immediately precipitates in conjunction with the alumine, and the sulphuric acid, in union with the alkali, remains in solution. After settling some time, the liquid is poured off, and the lake which has precipitated is formed into small squares, and dried. It is usual, I believe, to diffuse in the solution of alum a small quantity of the bark of an unknown shrub, called by the natives Autour Bark, after reducing it to a very fine powder; and this is supposed to promote the more complete precipitation of the colouring matter. The wax remaining, deprived almost entirely of its colour, is manufactured into that very useful article shel lac, by melting, straining, and forming it into very thin plates; becoming by this means, semi-transparent, and of an orange yellow hue.

Lac lake manufactured in the way described, when the squares are perfectly dry, assumes a dull brick colour on the outside; and after some time, a gray powder effloresces on the surface. When a square is broken, it appears of a dark chocolate colour in the inside, and the fracture is compact, smooth, and shining; scraped with a knife, the powder is of a red colour, inclining to crimson. These are the characteristic marks of good lac lake.

Compared with an equal weight of the best cochineal, the colouring matter of lac lake, PROPERLY DISSOLVED, is nearly equal in quantity to the colouring matter of the former.

Our East India Company have lately received a few chests of this colour, prepared in a different manner from that described. The squares are nearly black throughout, the exterior inclining to purple. This kind is not soluble in the same menstruum as the other, but may be used by grinding it in the mortar with a little hot water, and twice its weight of the composition; afterwards diluting it with a sufficient quantity of warm water to form the bath; the process, in every other particular, being the same as will hereafter be described for the other. Upon trying, separately, equal quantities of each kind, I did not find any perceptible difference in the quantity of colouring matter. The colour given to the patterns tried, were both very beautiful; but that given by the Company's was not so clear nor so intense as the other. This I impute to some quality in the solvent employed for the latter, and to the advantage it has over the Company's, from the depuration it undergoes after it is dissolved. This I think a very important advantage; for it is obvious, by mere inspection, on breaking a square, that the Company's contains some extraneous matter, which I take to be the web of the insect, dissolved and precipitated with the colour, and which undoubtedly sullies it on the cloth.

OF REFINED BORAX, THE PROPER SOLVENT OF LAC LAKE.

The crystals of refined Borax, in appearance somewhat resembles the crystals of Glauber's Salt. Borax is composed, according to Bergman, of

39 parts Boracic acid
17 — Soda
44 — Water.

From its component parts it is called, by scientific chymists, Borate of Soda.

Refined borax is white, transparent, and sometimes covered with a mealy powder; when broken, the fracture has a greasy appearance.

It dissolves in twelve times its weight of cold, and in six times

its weight of boiling water: its taste is not unpleasant, slightly acid and cool, leaving a sensation of sweetness on the tongue.

In its crude state it is called Tincal, Brute Borax, or Crysocolla. What we receive here comes chiefly from Bengal, where it is brought in its crude state, as dug out of the earth, from Persia and China. It is also found in abundance in the mines of Peru near Potosi, in South America.

The price of English refined borax, is generally from 2*s*. to 2*s*. 6*d*. per pound: in larger quantities, it may be purchased at a cheaper rate.

Although I consider refined borax as by far the best and most proper solvent of lac lake, yet I have found, that very pure crystals of soda will also dissolve a considerable portion of it, at a boiling heat; but this solution has not afforded me near so good a colour as the other. Perhaps methods may hereafter be found to employ it with advantage.

I have tried Potash in various ways, and degrees of strength: it takes up a little colour, but gives off a miserable one to the cloth.

OF SOLUTION OF TIN.

Solution of Tin, called also "Composition," and by our dyers "Spirits," is made by dissolving the purest grain tin in *Aqua Regia*, or nitro muriatic acid.

Aqua Regia may be made in various ways; but I shall only give that which is the most approved, and which experience has shewn to be the best adapted for the scarlet composition.

Into a large flint glass bottle, having a glass stopper, put one pound of the purest and strongest nitric acid, or aquafortis, and add to it an equal weight of water, filtered through blotting paper. Thus diluted, it should weigh about one-fourth more than an equal measure of water. To this must be added, one-eighth of its weight (four ounces) of refined sal ammoniac, previously bruised in a cloth, or broke into small pieces; afterwards putting the stopper in the bottle lightly, and setting it aside until the sal ammoniac is completely dissolved, which it will be in a day

or two. This will now form an aqua regia the most proper for our purpose.

Four ounces of the finest grain tin, in small pieces, is next to be added by degrees, and the bottle again slightly stopped, and set aside until the tin is dissolved. It will require some days before the solution of the tin is completely effected; and it is advantageous that it should go on slowly, and without effervescence: long experience having proved that a solution made without heat, and without the disengagement of much vapour, produces the best effects of the colour. The tin, by the action of the acid, will sometimes first assume the appearance of a salt, not unlike sugar of lead, before it entirely dissolves. It frequently happens that a small quantity of black sediment remains at the bottom of the bottle: from this the solution may be decanted, and, after washing out the bottle, poured back again.

The tin being dissolved, ten ounces (one-fourth the weight of the whole) of filtered water is to be added, and the solution laid by for use. It should now be transparent, and of a bright lemon yellow colour.

If the composition should be wanted in a shorter time than it will take to form by the foregoing method, the solution of the tin may be hastened by immersing part of the bottle in warm water: but care must be taken that the water is not too hot, and also to loosen the stopper, that some part of the vapour may escape; otherwise, the bottle will be liable to burst. It will be adviseable, while the solution of the tin is going on, to place the bottle where there is a current of air; and, as much as possible to avoid breathing any part of the noxious vapour that issues from it.

As fresh-made composition produces a finer colour than what has been long kept, it will be best to defer making it until a short time before it will be wanted. When it has been so long made, that a milky cloud begins to form, it will not produce so good a colour; but when it becomes a jelly (as some compositions made in the common way will do), it is utterly unfit for use. When this jelly first begins to form, it may be recovered by

adding to it, either a solution of common salt, or of sal ammoniac.

It will be necessary to be careful in choosing the tin as pure as possible: if the fine grain tin is not easily procured, the best bar tin may be used. This should be cut into lengths of an inch or two, melted in a brass ladle, and poured, while in fusion, into a large bason of water, to separate it into small pieces.

The method I have described of making the composition, is considered the best known, and is that which I have followed: but almost every dyer has his own receipt: and, no doubt, that which has produced him good effects with cochineal, will do the same with lac lake.

I shall conclude the subject with observing, that to be certain of the same results, the composition must be made uniformly in the same manner, and with the same proportion of ingredients.

OF WATER.

There is no colour in the art of dyeing, that requires so much attention to the water employed, as scarlet. It should be what is well known under the denomination of soft water, and it should be perfectly tasteless, clear of floating particles, and transparent. Water that has made a long course undisturbed, exposed to the sun and air, and afterwards left to settle, generally possesses these qualities in perfection. But it may happen, that water shall be exceedingly clear and transparent, yet hold many earthy and metallic particles in solution: when this is the case, it may be known by a peculiar taste, and by the circumstance of curlding soap attempted to be dissolved in it. What has just issued from wells, is mostly of this description; it is called hard water, and cannot be used for dyeing scarlet.

The earthy and metallic principles most common in water, and those most injurious to the scarlet dye, are lime and iron: therefore, if it be possible, the use of water that has passed in its course over beds of calcareous earth and lime-stone, or through iron pipes, should be avoided; for although the portion of these substances taken up by water is very minute, and considered be-

neficial to the human constitution when drank, yet they may in some degree tarnish the delicate colour of scarlet.

Before the water is let into the cistern or vats, the state of the river must be attended to: after heavy rains and stormy weather it will be muddy, coloured, and unfit for use; it must therefore be left some days after such weather, to settle and deposit the earthy and other matters floating in it, and should not be let into the vessels until it recovers its clearness and transparency; and even after that, it should remain some days longer in the cistern undisturbed, to acquire the utmost degree of purity, before it is drawn off for the boiling, or to prepare the colour.

With these precautions the most brilliant colours may be expected.

OF THE BOILING, OR PREPARATIONS OF THE CLOTH WITH THE MORDANT.

Woollen cloth would neither receive nor retain the colouring particles of the scarlet dye without undergoing a previous preparation by boiling it in what is usually called the mordant. Dyers name this operation "the boiling."

The ingredients for the boiling, are cream of tartar, and solution of tin: of these, the proportions used, vary almost in every dye-house. Those which I shall give, I by no means give as the best; but, I can state, that the cloth prepared according to them (on the smallest scales) has always taken as beautiful and as intense a colour as could be desired: I believe that the proportions most commonly employed are about one-eighth less, but seldom more: and I have understood that many dyers make the proportion of solution of tin less than the tartar.

Proportion of ingredients for the boiling on different scales.

Cloth.	Water.	Tartar.	Solution of tin.	To boil.
1 oz.	1 quart	1 drm.	1 drm.	1½ hours
8 oz.	2 gallons	1 oz.	1 oz.	ditto
1 lb.	4 gallons	2 oz.	2 oz.	ditto
20 lbs.	80 gallons	2½ lbs.	2½ lbs.	ditto

It is necessary to observe, that evaporation goes on much

more quickly in small vessels than in large ones; it will be better in performing the process on the smaller scales, to employ only *half the quantity* of cloth stated, otherwise it is probable there will not be enough of the liquid left towards the end of the boiling, and the experiment will not succeed.

For the purpose of making this experiment it will be necessary to provide a well glazed earthen pan, having a cover and a handle, taking care that the cover does not project beyond the sides, to intercept the smoke, when charcoal is employed in an open stand. If this pan could be set on a small furnace to prevent the injury that may arise from the smoke, it would answer much better; but if this cannot be done, a charcoal stand may be placed on the hearth of a fire place where there is a good draught of air up the chimney, and a sufficient quantity of good charcoal provided. Care must be taken that the stand be large enough, and contain sufficient firing to keep the liquid boiling, and it should be so made that fuel may be supplied without taking off the pan. The pan should hold about one gallon and a half of water; and having set it on the stand with *one gallon* of clear and soft water, (that has either been filtered, or stood ten or twelve hours to settle) the fire is to be lighted. When the water is warm, four drams of very pure cream of tartar is to be put into it, stirring it with a stick made of a piece of fir lath. When the tartar is dissolved, the same quantity (four drams) of solution of tin is to be poured in by degrees, stirring gently as this is done. When the bath begins to boil, a pattern of cloth, weighing about two ounces or less, is to be put in, moving it about rather quickly at first, and afterwards from time to time more slowly. The pattern must be boiled one hour and a half, then taken out, cooled, washed in a bason of clear water, and hung up to dry where it will not be exposed to dust or dirt of any kind. It will now be prepared for the dye, *instructions* for which will be given in a subsequent chapter. To dyers accustomed to prepare cloth on a large scale, any directions for the boiling will be unnecssary.

OF THE PREPARATION OF THE SOLUTION OF LAC LAKE FOR THE COLOURING BATH.

The squares of lac lake should be thrown into a vessel of warm water, and after remaining a short time, well brushed with a clean brush kept for the purpose, in order to clean off any dust or dirt adhering to the surface; rinsing them out afterwards in fresh water. The lake is then to be reduced to a very fine powder in a mortar,* and passed through a sieve: the finer the powder, the more easily and more completely will the colour dissolve.

An equal weight of refined borax is next to be powdered separately, but not sifted, and the powdered lake returned into the mortar upon the borax, working the pestle till they are well mixed with each other.

Before proceeding to the method of preparing the colouring bath, it is necessary to remark, that the quantity of colouring matter in the same weight of different kinds of lac lake is not always the same; although I am convinced it does not vary so much in this respect as cochineal: I will suppose, however, that we are operating with such as possesses the characteristic marks formerly described: In that case, the proportions to be observed on the different scales may be as follows.

Cloth.	Water.	Lake and Borax.	
1 oz.	1 quart	1 drm. Lake 1 drm. Borax	} or 2 drms. of mixed powder.
8 oz.	2 gallons	1 oz. Lake 1 oz. Borax	} or 2 oz. ditto
1 lb.	4 gallons	2 oz. Lake 2 oz. Borax	} or 4 oz. ditto
20 lbs.	80 gallons	2½ lbs. Lake 2½ lbs. Borax	} or 5 lbs. ditto

The proportion of lac lake prescribed above, is more than is used of the *best* cochineal, for the same weights of cloth; but I believe it does not much exceed the quantity of cochineal em-

* Those mortars manufactured and sold by Mr. Mist, of Fleet-street, answer the purpose better than any other, not being subject to abrasion, nor attackable by acids.

ployed by our best dyers for full and deep colours; and without knowing the practice of different dye-houses it is impossible for me to speak with certainty on this point. Besides, the grounds that remain in the vessel in which the lake is dissolved, contains a considerable quantity of colour.

I have before stated that a glazed earthen vessel should be procured for the purpose of making the solution of the colour.* Into this vessel is to be put that proportion of the mixed powder necessary for the cloth to be dyed, and half the quantity of water mentioned above, (previously heated to the boiling point) poured upon it. When all the water is poured in, it should be stirred well about a minute,† the lid put on, and covered with thick cloths to retain the steam and heat. It should be left to rest and digest for fifteen minutes and then stirred, covered up for fifteen minutes more, and then stirred again. After this, it should remain undisturbed for half an hour at least, to let the grounds settle to the bottom, before it is drawn off into the boiler.

Only half the quantity of water prescribed for the dyeing bath has been recommended for making this solution, having generally found that the whole quantity weakened the power of the solvent too much.

The grounds that remain at the bottom of the vessel in which the solution was made, will still be found to contain a quantity of colour, more or less, according to the fineness of the powder to which the lake was reduced, and the care with which the solution was conducted, as well as to the qualities of the lake itself, which is seldom entirely soluble by borax. After the solution by the borax has been drawn off into the boiler, a small portion of the grounds that remain, must be taken out, and put into a glass tumbler with (as near as can be guessed if the grounds were dry) an equal weight of powdered *borax*: boiling water should then be poured on them in the proportion of one pint to a dram of

* Having only employed a vessel of this kind, is the reason I mention it exclusively, probably a wooden or metal one would answer as well.

† For stirring the solution I should prefer a pole of fir, because other wood may contain principles injurious to the colour.

borax; if the grounds are soluble by these means, it will immediately be seen, and they should be treated exactly in the same manner as at first: but if no colour is taken up by the liquid, the grounds will be found to be soluble in the solution of tin, which may be mixed with them in a proportion *not* exceeding under any circumstances, the original weight of the compound powder, the quantity to be determined by that of the colouring matter which appears to remain in the undissolved grounds; they should be ground together in the mortar, and then returned into the dissolving vessel to be diluted with warm water sufficient to form the bath, and after stirring the mixture well, immediately drawn off into the boiler *without* allowing it to settle; operating on the cloth with this bath in the same way as with the former one; and not adding any more solution of tin, unless it appears to be absolutely necessary, but cream of tartar must be added, at the expiration of fifteen minutes, in the same proportion as to the former bath.

Although from this bath the finest colour ought not to be expected, yet I have freqently produced tints from it very little inferior, sometimes equal to any I have ever seen.

I have directed the mixture for this bath to be drawn off into the boiler, immediately after having been stirred, and without allowing it to settle: because the solution of tin after dissolving the colour, lets it precipitate slowly, and most minutely divided; for this reason, I am of opinion that a small quantity of starch added to this bath would be very advantageous, inasmuch as it would contribute to keep the colouring particles longer suspended in the liquid, to dye cloth more evenly, and to assist it in depriving the bath more effectually of its colour.

I have found it exceedingly advantageous, expeditious, and economical, to pour the subsequent solution or mixture in the composition, into the first exhausted bath after the finer colours have been dyed in it; but in this case, the quantity of composition used for the solution of the grounds must be lessened, and very little warm water employed to dilute it; the quantity of tartar also must be reduced, because a considerable portion of

these matters remain in the first exhausted bath, and too much of them would be very injurious.

OF DYEING SCARLET IN THE COLOURING BATH PREPARED WITH LAC LAKE.

The remaining half of the water required for this bath, as mentioned in the preceding chapter, is to be put into the boiler,* and when a little more than warm, the solution of lac lake is to be poured in, taking care in drawing off the last portion to stop the vessel a little towards the cock, and also that no part of the grounds should mix with it.

When this bath is near boiling, a quantity of solution of tin, equal in weight to the mixed powder, or *twice the weight of the lac lake*, is to be poured in, stirring the bath gently. When it begins to boil, the cloth must be put in, moving it at first very quickly by means of the roller, until the cloth has run its whole extent backwards and forwards several times, after which, it may be moved more slowly. Having boiled for a quarter of an hour, the cloth is either to be lifted out and placed on the scraw, or wound rapidly on the roller. A quantity of cream of tartar in very fine powder, *one-fourth the weight of the lac lake*, is then to be added to the bath, stirring it briskly. In five minutes from the time it was taken out, the cloth must be returned into the bath, and moved again quickly for a few turns, and afterwards more slowly. It must now be kept boiling moderately for one hour and fifteen minutes, making the whole time it has boiled one hour and a half, a little longer or a little shorter according to the depth of colour required.

For colouring the small pattern mentioned in the fifth chapter one ounce of the mixed powder of lac lake and borax is to be put into a jug, and two quarts of boiling water out of a kettle poured on it by degrees; having previously taken care that the kettle was clean, and the water pure: it would also be proper to let the water settle in the kettle eight or ten minutes after it is taken off the fire, and before it is poured into the jug. After

* The boiler should be of block tin, or of copper well tinned.

stirring the liquid from time to time for a quarter of an hour, covering the jug always after it is stirred, it should be left to settle undisturbed for half an hour, at the end of which time it may be poured into the earthen pan in which the boiling with the mordant was performed, having previously washed the pan very clean, and warmed two quarts of water in it to complete the quantity necessary for the bath, and being cautious that no part of the grounds in the jug should mix with the solution as it is poured out. When this bath is ready to boil, an ounce of the composition is to be poured in and stirred. Some minutes afterwards the pattern of cloth should be put in, moving it about quickly at first. After being in the bath about a quarter of an hour or less, it must be taken out and one dram of fine cream of tartar added to the bath, which must be stirred for two or three minutes, and then the cloth returned and boiled for about an hour and a quarter, moving it about during this time frequently and slowly. If it is desired that the shade should be light, it must not boil so long.

The pattern is now to be taken out, cooled, rinsed in a bason of cold water, and hung up to dry with the same precautions, in securing it from dust and dirt, as mentioned in drying it after the boiling.

AN EXCELLENT COLOURLESS COPAL VARNISH.

By Mr. LENORMAND, *late Professor of Natural Philosophy.**

EVERY one knows the difficulty of dissolving copal completely, when we attempt to make a varnish, I hasten therefore to communicate a method, that has succeeded perfectly with me; and which will be found, to produce a very fine varnish with this substance.

All copal is not fit for making this varnish, it must therefore be selected with care, and the following method will show what is good. Take each piece of copal separately, and let fall on it

* Sonnini's Bibliothèque Physico-économique for 1808, Vol. II. p. 133.

a single drop of very pure essential oil of rosemary, not altered by keeping. Those pieces on which the oil makes a certain impression, that is to say, which soften at the part that imbibes the oil, are good, and should be reserved for making varnish. The other ought to be rejected.

Powder the pieces of copal thus selected, sift the powder through a very fine hair sieve, and put it into a glass, on the bottom of which it must not lie more than a finger's breadth thick. On it pour essence of rosemary to a similar height, stir the whole together with a stick for a few minutes, the copal will dissolve into a viscous substance, and the whole will form a very thick fluid. Let it stand for a couple of hours, after which pour on gently two or three drops of very pure alcohol, which you will distribute over the oily mass by inclining the glass in different directions with a very gentle motion. In this way you will effect their incorporation. Repeat this operation by little and little, till the varnish is reduced to a proper degree of fluidity. Remember, the first drops of alcohol are the most difficult, and require the longest time to incorporate; and that the difficulty diminishes as each successive addition is incorporated, or as the mass approaches the state of saturation.

When the varnish has attained the suitable degree of fluidity, it is to be suffered to stand a few days; and when it has become very clear, the varnish is to be decanted off.

The magma that remains at the bottom may still be rendered useful, by pouring on alcohol in the manner directed above; but care must be taken, to add very little at a time.

This varnish is made without heat, is very clear and colourless, may be applied with equal success on pasteboard, wood, and metals, and may be worked and polished with ease, indeed better than any known varnish. It may be used on paintings, and singularly heightens their beauty.

PAPERS ON

RURAL AND DOMESTIC ECONOMY.

REMEDY FOR THE PEACH WORM.

By Mr. JOHN H. COCKE.

For the Archives of Useful Knowledge.

Bremo, Fluvanna County, (Virg.) May, 1812.

SIR,

THE information which you have diffused throughout the United States by your publications on subjects of rural economy, establish a high claim to the gratitude of American agriculturalists; and as there is no return so acceptable to the enlightened labourer for the public good, as contributions, however small, which enable him to add to the stock of useful information, no apology is therefore deemed necessary for a stranger's addressing you, who presumes he may add a mite to the contents of the *Archives*.

A remedy against the insect which deposits its eggs in the bark of the peach tree, has become an object of importance in the cultivation of this valuable fruit. The peach trees all over Virginia have experienced the destructive effects of this insect, and accordingly various remedies have been tried, some of which for a time have promised success, but finally issued in disappointment. The fly or insect lays its eggs in the bark of the tree, just at the surface of the earth, where the rougher and harder bark which is exposed to atmospherical influences, begins to change to the softer character of that which envelops the roots. In this particular part the insect is able to puncture the surface, and there introduces its eggs. This they perform in our climate from the middle of July, through August and September. I have some where seen it stated, perhaps in the transactions of the Philadelphia Agricultural Society, that this insect deposits its

eggs in the spring as well as the latter part of summer and first of autumn. I have never known them to exist in the fly state sooner than the last of July, but chiefly in August and September. In August for the most part, I find the worms have assumed the chrysalis state, and soon after, say 8 or 10 days, are transformed into flies, and then they immediately begin to deposit their eggs, which are soon hatched into worms, and thus the round of transformation, common to the insect tribe, is completed. While in the worm state they do the mischief, by preying upon the soft inner bark of the tree, which is the medium of circulation for the sap; thus interrupting the flow of the sap. The immediate consequence of which is the destruction of the fruit, and finally the destruction of the tree.

I think I have discovered a remedy for this mischievous insect, in tobacco. As much cured tobacco as is tied up in a bundle for prizing (that is from four to six leaves) is sufficient for a tree. The tobacco, in a moist state, so as to render it flexible, is bound around the body of the tree just at the surface of the earth, encircling the part where the flies deposit their eggs. This precaution is to be taken a little before the hatching of the flies; the middle of July I find is early enough here. I do not attribute the success of this remedy to its covering the vulnerable part of the tree merely; for in using common straw and other coverings in a similar way, I failed. In those cases, the fly would get as close to its favourite region, as the covering would permit, and finding some fissure in the bark, would there deposit its eggs; but the tobacco, which in its essential qualities is so generally deleterious to the insect tribe, is so also, I suppose, to this destsuctive fly, and thereby prevents its approach. Be this however as it may, I will go on to detail my experience as to the fact. I made my first experiments with tobacco three years past this summer, and was led to them by a previous knowledge of its destructive effects on the moth, cabbage-lice, &c. I had been disappointed in many of the remedies which, upon obtaining the transactions of the Philadelphia Agricultural Society, I found judge Peters and others had tried with similar disappoint-

ment: such as exposing the roots to frost, wrapping the bodies in straw, &c. &c. My first experiments with tobacco were confined to 10 or 12 trees: the next spring, I found that the trees still threw out gum at the surface of the earth, and I apprehended my experiment had failed; upon a close examination, however, I perceived that the gum had issued from the old wounds of the worms of the former year, which were not yet entirely healed. The succeeding summer I extended the experiment to all my peach trees of favourite selected fruit, consisting of between 50 and 100 trees; and the same result was observed as in the preceding spring: in many cases gum issuing from the old wounds, but no worms in any instance where the tobacco had been applied. The last summer I again applied the tobacco upon a still larger scale; and this spring have assiduously examined the trees. I find, that those which have had the benefit of the tobacco application two successive years, have all their wounds entirely healed, and throw out no gum, and in no instance have I found the worm to have existed where the tobacco has been used.

I am, Sir, yours respectfully,

JNO. H. COCKE.

Dr. MEASE,
Philadelphia.

IMPROVEMENT IN ARGAND'S LAMP.

THE advantages of the Argand lamp, are derived from the circular shape of the wick, by which a current of air rushes through the cylinder on which it is placed, and together with that which has access to the outside, excites a flame to such a degree, that the smoke is entirely consumed. Thus both the light and heat are much increased, the combustion being augmented by the quantity of air admitted to the flame; and what in common lamps is dissipated in smoke, is in this converted into a brilliant flame. The defects in this lamp are, that the reservoir for the oil being at a distance from the burning body, occasions

in cold weather, a coagelation of fluid, so as to prevent its flowing freely, and the brilliancy of the light is greatly diminished; another circumstance which lessens its value is, that only the best oil can be successfully used in it, because, from its construction, the sediment of impure oil clogs the wick, and renders the light dim. To remedy these defects, Mr. John Turmeau, and Charles Seward, of Cheapside, have contrived another lamp of a more simple form. In this there are neither fountains, valves, nor tubes, by which the oil can be impeded in its progress to the wick: the distance between the reservoir for the oil and flame, is such as to favour the ascent of the oil in the wick, and likewise to keep the oil in a perfectly fluid state even in the severest frost: instead of one cylindrical wick, there are three flat wicks placed in the chords of a circle, with a wide space for the admission of air between each: besides this, there is a current of air admitted through the body of the lamp to the centre of the wick-circle, and the glass chimney is elevated about an inch above the flame, by which means the greatest possible quantity of atmospheric air is thrown upon the flame; of course there is an abundant supply of oxygen, which occasions the complete combustion of all the inflammable matter, the whole of the smoke is consumed, and the most brilliant light that can be conceived is produced. It is called the "Liverpool Lamp." *Monthly Mag. London, January* 1812.

TO CONVEY FISH.

CRUMB of bread is to be soaked in brandy, and when well swelled, the fish's mouth is filled therewith, into which a half glass more of the spirit is then to be poured. The fish remains motionless, and as if deprived of life, in which state it is to be wrapped in fresh straw, and afterwards in a cloth. In this condition they may be kept, or conveyed to any distance for 8 or 10 days. When arrived at the place of destination, they must be unpacked, and thrown into a cistern of water, where they remain a quarter of an hour, or sometimes an hour, without shewing any

signs of life; but at the end of that time they disgorge very abundantly, and recover their life and ordinary motions.*

Catfish may be conveyed in a cart for many miles, by being surrounded with fresh grass, provided spring water is frequently dashed over them. The journey ought to be commenced a little before day, so that the fish may be put into the pond destined for them, before the heat of the day.

Dr. Mitchill, of New York, relates that in 1790, he in company with another gentleman, transported yellow perch 40 miles, viz. from Rockonkoma pond in Suffolk county, to Success pond in North Hempstead, Long Island. Three dozen of those which had been most superficially wounded by the hook were taken, and all except two swam away when put into the pond. A large churn was filled with the water of their native pond, and so few fishes put in, that there was no necessity of changing it on the road, and afterwards driving steadily on a walk the whole distance, without stopping to refresh either man or horse. In two years these fishes multiplied so fast and became so numerous, that they might be caught with the hook in any part of the water, which is about a mile in circumference.†

TO DRY PEACHES.

The following mode of drying peaches is adopted by Thomas Belanjee, of Egg-Harbour, New Jersey.

HE has a small house with a stove in it, and drawers in the sides of the house, lathed at their bottoms. Each drawer will hold nearly half a bushel of peaches, which should be ripe, and not peeled, but cut in two and laid on the laths with their skins downwards so as to save the juice. On shoving the drawer in they are soon dried by the hot air of the stove and laid up. Peaches thus dried are clear from fly-dirt, excellently flavoured, and command a high price in market. Pears thus dried eat like rai-

* Nicholson's Philosophical Journal, Vol. 15, p. 263.

† Medical Repository, Vol. 3, p. 422.

sins. With a paring machine, which may be had for a dollar or two, apples or pears may be pared, and sufficient quantity dried, to keep a family in pies, and apple bread and milk, till apples come again. With a paring machine, one person can pare for five or six cutters.

TO DESTROY WEEVILS IN BARNS.

By Mr. GAVIN SCOTT, *of Elizabeth-town, New Jersey.*

I WAS much infested with weevils in my barn, &c. and did not know how to get rid of them, till I found tobacco was an effectual remedy. They are fond of it, eat it, and go off and die. I deal in tobacco, and receiving two hogsheads (for which I had not room in my cellar at the time) I put them into the barn. On removing them, I found thousands of dead weevils on the barn-floor, which cleared it entirely of that destructive animal. I then took two or three boxes, containing about six pounds of tobacco in each, and placed them in my granary, where I kept wheat, &c. This was soon cleared also, and I have not had any since. The boxes ought to be open enough to let the weevils have free passage into them.

December, 28, 1808.

The good effects of tobacco leaves strewed about a barn or granary, in killing weevils, have been recently confirmed to the Editor by an agricultural friend.

TO MAKE CIDER-OIL.

THIS liquor is a very favourite drink with a large portion of our German citizens, and of an agreeable flavour, when diluted, to most persons. The following receipt has been communicated to the Editor by a person well acquainted with the mode of compounding the liquor.

The cider must be well racked two or three times in clear

weather. Four gallons of best apple-brandy are then to be added to each barrel of cider, if the cider be weak, but if it be strong, less will suffice. An infusion of Sassafras root, made by putting a piece of about the size of a finger, and chipped fine, into a pint of water, improves the flavour. The barrel is then to be rolled.

In years when apples are abundant, cider even of a good quality brings only a small price; but by converting it into cider-oil, it may be preserved until the following spring, and will then commonly sell well.

ON THE REVIVAL OF AN OBSOLETE MODE OF MANAGING STRAWBERRIES.

By the right hon. Sir JOSEPH BANKS, *Bart. K.B. P.R.S. &c.**

THE custom of laying straw under strawberry plants, when their fruit begins to swell, is probably very old in this country: the name of the fruit bears testimony in favour of this conjecture, for the plant has no relation to straw in any other way, and no other European language applies the idea of straw in any shape to the name of the berry, or to the plant that bears it.

When Sir Joseph Banks came to Spring Grove, in 1779, he found this practice in the garden: John Smith, the gardener, well known among his brethren as a man of more than ordinary abilities in the profession, had used it there many years; he learned it soon after he came to London from Scotland; probably at the Neat Houses, where he first worked among the market gardeners, it is therefore clearly an old practice, though now almost obsolete.

Its use in preserving a crop is very extensive: it shades the roots from the sun; prevents the waste of moisture by evaporation, and consequently, in dry times, when watering is necessary, makes a less quantity of water suffice than would be used if the

* From Transac. of the Horticultural Society, London, Vol. I, Part I, p. 57.

sun could act immediately on the surface of the mould; besides, it keeps the leaning fruit from resting on the earth, and gives the whole an air of neatness as well as an effect of real cleanliness, which should never be wanting in a gentleman's garden.

The strawberry beds in that garden at Spring Grove, which has been measured for the purpose of ascertaining the expense incurred by this method of management, are about 75 feet long, and five feet wide, each containing three rows of plants, and of course requiring four rows of straw to be laïd under them. The whole consists of 600 feet of beds, or 1800 feet of strawberry plants, of different sorts, in rows. The strawing of these beds consumed this year, 1806, the long straw of 26 trusses, for the short straw being as good for litter as the long straw, but less applicable to this use, is taken out; if we allow then, on the original 26 trusses, six for the short straw taken out and applied to other uses, 20 trusses will remain, which cost this year 10*d.* a truss, or 16*s.* 8*d.* being one penny for every nine feet of strawberries in rows.

From this original expenditure the value of the manure made by the straw when taken from the beds must be deducted, as the whole of it goes undiminished to the dung-hill as soon as the crop is over. The cost of this practice, therefore, cannot be considered as heavy; in the present year not a single shower fell at Spring Grove, from the time the straw was laid down till the crop of scarlets was nearly finished, at the end of June. The expense of strawing was therefore many times repaid by the saving made in the labour of watering, and the profit of this saving was immediately brought to account in increase of other crops, by the use of water spared from the strawberries; and besides, the berries themselves were, under this management, as fair and nearly as large as in ordinary years, but the general complaint of the gardeners this year was, that the scarlets did not reach half their natural size, and of course required twice as many to fill a pottle as would do it in a good year.

In wet years the straw is of less importance in this point of view, but in years moderately wet, the use of strawing some-

times makes watering wholly unnecessary, when gardeners who do not straw are under the necessity of resorting to it; and we all know if watering is once begun, it cannot be left off till rain enough has fallen to give the ground a thorough soaking.

Even in wet years the straw does considerable service: heavy rains never fail to dash up abundance of mould, and fix it upon the berries, this is entirely prevented, as well as the dirtiness of those berries that lean down upon the earth, so that the whole crop is kept pure and clean: no earthy taste will be observed in eating the fruit that has been strawed, and the cream which is sometimes soiled when mixed with strawberries, by the dirt that adheres to them, especially in the early part of the season, will retain to the last drop that unsullied red and white, which give almost as much satisfaction to the eye while we are eating it, as the taste of that most excellent mixture does to the palate.

REMARKS.

Upon mentioning the use of straw to a gardener, (G. Esher,) who is well known for raising very large and very fine strawberries, he said that he had been induced to use straw, from supposing that in a dry season, it would keep the ground moist, and that in wet weather, the soil would be prevented from being splashed up on the fruit. He had not seen the practice recommended in any book. The first year he was pleased with the experiment, but the second year, after he was done picking, the vines were so much destroyed by grasshoppers and crickets, that he calculates his loss at $500, and he was obliged to renew his beds. The gardener of a neighbouring gentleman also tried the straw, and with the same unfortunate results. It is now four years since the straw was first used, and he has not yet been able to clear his garden of the destructive pests. They begin their depredations about August, and only attack the vines of the third year. The plan fallen upon by Mr. Esher, to subdue the insects, is to mow off the vines close immediately after the season for picking is over, to pull out the runners and weeds, and to

clean up the beds in the neatest manner, so as to give no harbour to them. In the room of straw, he spreads green grass, *(poa viridis)* and with good effect. Probably if the vines had been mowed, and the rotten straw carefully raked off, the insects by being deprived of a harbour, would not have appeared.

Editor.

ON THE ECONOMY OF BEES.

In a letter from THOMAS ANDREW KNIGHT, *Esq. F. R. S. to the right hon. Sir Joseph Banks, Bart. K. B. P. R. S.**

MY DEAR SIR,

IN the prosecution of those experiments on trees, accounts of which you have so often done me the honour to present to the Royal Society, my residence has necessarily been almost wholly confined to the same spot; and I have thence been induced to pay considerable attention to the economy of bees, amongst other objects; and as some interesting circumstances in the habit of these singular insects appear to have come under my observation, and to have escaped the notice of former writers, I take the liberty to communicate my observations to you.

It is, I believe, generally supposed, that each hive, or swarm, of these insects remains at all times wholly unconnected with other colonies in the vicinity; and that the bee never distinguishes a stranger from an enemy. The circumstances which I shall proceed to state, will, however, tend to prove, that these opinions are not well founded, and that a friendly intercourse not unfrequently takes place between different colonies, and is productive of very important consequences in their political economy.

Passing through one of my orchards rather late in the evening, in the month of August, in the year 1801, I observed, that several bees passed me in a direct line from the hives in my own

* Philosophical Transactions for 1807, Part II, p. 234.

garden to those in the garden of a cottager, which was about a hundred yards distant from it. As it was considerably later in the evening than the time when bees usually cease to labour, I concluded that something more than ordinary was going forward. Going first to my own garden, and then to that of the cottager, I found a very considerable degree of bustle and agitation to prevail in one hive in each: every bee, as it arrived, seemed to be stopped and questioned, at the mouth of each hive; but I could not discover any thing like actual resistance, or hostility, to take place; though I was much inclined to believe the intercourse between the hives to be hostile and predatory. The same kind of intercourse continued, in a greater or less degree, during eight succeeding days, and though I watched them very closely, nothing occurred to induce me to suppose, that their intercourse was not of an amicable kind. On the tenth morning, however, their friendship ended, as sudden and violent friendships often do, in a quarrel; and they fought most furiously; and after this there was no more visiting.

Two years subsequent to this period, I observed the same kind of intercourse to take place between two hives of my own bees, which were situate about two hundred yards distant from each other: they passed from each hive to the other just as they did in the preceding instance, and a similar degree of agitation was observable. In this instance, however, their friendship appeared to be of much shorter duration, for they fought most desperately on the fifth day; and then, as in the last mentioned case, all further visiting ceased.

I have some reason to believe, that the kind of intercourse I have described, which I have often seen, and which is by no means uncommon, not unfrequently ends in a junction of the two swarms; for one instance came under my observation, many years ago, in which the labouring bees, under circumstances perfectly similar to those I have described, wholly disappeared, leaving the drones in peaceable possession of the hive, but without any thing to live upon. I have also reasons for believing, that whenever a junction of two swarms, with their property, is

agreed upon, that which proposes to remove, immediately, or soon afterward, unites with the other swarm, and returns to the deserted hive during the day only to carry off the honey: for having examined at night a hive from which I suspected the bees to be migrating, I found it without a single inhabitant. I was led to make the examination by information I had received from a very accurate observer, that all the bees would then be absent. A very considerable quantity of honey was in this instance left in the hive without any guards to defend it; but I conclude, that the bees would have returned for it, had it remained till the next day. Whenever the bees quit their habitation in this way, I have always observed some fighting to take place; but I conceived it to be between the bees of the adjoining hives, and those which were removing; the former being attracted by the scent of the honey, which the latter were carrying off.

On the farm which I occupy, there were formerly many old decayed trees, the cavities of which were frequently occupied by swarms of bees; and when these were destroyed, a board was generally fitted to the aperture, which had been made to extract the honey; and the cavity was thus prepared for the reception of another swarm, in the succeeding season. Whenever a swarm came, I constantly observed, that about fourteen days previous to their arrival, a small number of bees, varying from twenty to fifty, were every day employed in examining, and apparently in keeping possession of the cavity; for if molested, they showed evident signs of displeasure, though they never employed their stings in defending their proposed habitation. Their examination was not confined to the cavity, but extended to the external parts of the tree above; and every dead knot particularly arrested their attention, as if they had been apprehensive of being injured by moisture, which this might admit into the cavity below; and they apparently did not leave any part of the bark near the cavity unexamined. A part of the colony, which purposed to emigrate, appeared in this case to have been delegated to search

for a proper habitation ;* and the individual who succeeded must have apparently had some means of conveying information of his success to others ; for it cannot be supposed, that fifty bees should each accidentally meet at and fix upon, the same cavity, at a mile distant from their hive, which I have frequently observed them to do, in a wood where several trees were adapted for their reception ; and indeed I observed, that they almost uniformly selected that cavity, which I thought best adapted to their use.

It not unfrequently happened, that swarms of my own bees took possession of these cavities, and such swarms were in several instances followed from my garden to the trees : and they were observed to deviate very little from the direct line between the one point and the other ; which seems to indicate, that those bees, which had formerly acted as purveyors, now became guides.

Two instances came under my own observation, in which a swarm was received into a cavity, of which another swarm had previous possession. In the first instance I arrived with the swarm, and I could not discover, that the least opposition was made to their entrance : in the second instance, observing the direction that the swarm took, I used all the expedition I could to arrive first at the tree, to which I supposed they were going, whilst a servant followed them ; and a descent of ground being in my favour, and the wind against them, I succeeded in arriving at the tree some seconds before them ; and I am perfectly confident, that not the least resistance was opposed to their entrance.

Now it does not appear probable, that animals so much attached to their property as bees are, so jealous of all approach towards it, and so ready to sacrifice their lives in defence of it, should suffer a colony of strangers, with whose intentions they were unacquainted, to take possession, without making some effort to defend it : nor does it seem much more probable, that

* The Editor heard this opinion, supported by some farmers in Pennsylvania, several years since ; and whoever will attend to the precise and direct manner in which a swarm flies to a distant hollow tree, will not be able to account for the fact upon any other principle.

the same animals, which spent so much time in examining their future habitation, in the cases I have mentioned, should have attempted in this case to enter without knowing whether there was space sufficient to contain them, and without any examination at all. I must therefore infer, that some previous intercourse had taken place between the two swarms, and that those in the possession of the cavities were not unacquainted with the intentions of their guests; though the formation of any thing like an agreement between the different parties, be scarcely consistent with the limitations generally supposed to be fixed by nature to the instinctive powers of the brute creation.

Brutes have evidently language; but it is a language of passion only, and not of ideas. They express to each other sentiments of love, of fear, and of anger; but they appear to be wholly incapable of transmitting to each other any ideas they have received from the impression of external objects. They convey to other animals of their species, on the approach of an enemy, a sentiment of danger; but they appear wholly incapable of communicating what the enemy is, or the kind of danger apprehended. A language of more extensive use seems, from the preceding circumstances, to have been given to bees; and if it be not, in some degree, a language of ideas, it appears to be something very similar.

When a swarm of bees issues from the parent hive, they generally soon settle on some neighbouring bush or tree; and as in this situation they are generally not at all defended from rain or cold, it is often inferred, that they are less amply gifted with those instinctive powers, that direct to self-preservation, than many other animals. But their object in settling soon after they leave the hive is apparently nothing more than to collect their numbers; and they have generally, I believe always, another place to which they intend subsequently to go: and if the situation they select be not perfectly adapted to secure them from injuries, it is probably, in almost all instances, the best they can discover. For I have very often observed, that, when one of my hives was nearly ready to swarm, one of the hollow trees I have

mentioned (and generally that best adapted for the accommodation of a swarm) was every day occupied by a small number of bees; but that after the swarm had issued from that hive, and had taken possession of another, the tree was wholly deserted; whence I inferred, that the swarm, which would have taken possession of the cavity of that tree, had relinquished their intended migration, when a hive was offered them at home. And I am much disposed to doubt, whether it be not rather habit, produced by domestication, during many successive generations, than any thing inherent in the nature of bees, which induces them to accept a hive, when offered them, in preference to the situation they have previously chosen: for I have noticed the disposition to migrate to exist in a much greater degree in some families of bees than in others; and the offspring of domesticated animals inherit, in a very remarkable manner, the acquired habits of their parents. In all animals this is observable: but in the dog it exists to a wonderful extent; and the offspring appears to inherit not only the passions and propensities, but even the resentments of the family from which it springs. I ascertained by repeated experiment, that a terrier, whose parents had been in the habit of fighting with polecats, will instantly show every mark of anger, when he first perceives the scent of that animal; though the animal itself be wholly concealed from his sight. A young spaniel brought up with the terriers showed no marks whatever of emotion at the scent of the polecat; but it pursued a woodcock, the first time it saw one, with clamour and exultation: and a young pointer, which I am certain had never seen a partridge, stood trembling with anxiety, its eyes fixed, and its muscles rigid, when conducted into the midst of a covey of those birds. Yet each of these dogs is a mere variety of the same species; and to that species none of these habits are given by nature. The peculiarities of character can therefore be traced to no other source than the acquired habits of the parents, which are inherited by the offspring, and become what I shall call instinctive hereditary propensities. These propensities, or modifications of the natural instinctive powers of animals, are capable of endless

variation and change; and hence their habits soon become adapted to different countries and different states of domestication, the acquired habits of the parents being transferred hereditarily to the offspring. Bees, like other animals, are probably susceptible of these changes of habit, and thence, when accustomed through many generations to the hive, in a country which does not afford hollow trees, or other habitations adapted to their purpose, they may become more dependent on man, and rely on his care wholly for a habitation; but in situations where the cavities of trees present to them the means of providing for themselves, I have found, that they will discover such trees in the closest recesses of the woods, and at an extraordinary distance from their hives; and that they will keep possession of such cavities in the manner I have stated: and I am confident that, under such circumstances, a swarm never issues from the parent hive, without having previously selected some such place to retire to.

It has been remarked by Mr. John Hunter, that the matter which bees carry on their thighs is the farina of plants, with which they feed their young, and not the substance with which they make their combs; and his statement is, I believe, perfectly correct: but I have observed, that they will also carry other things on their thighs. I frequently covered the decorticated parts of trees on which I was making experiments, with a cement composed of bees-wax and turpentine; and in the autumn I have frequently observed a great number of bees employed in carrying of this substance. They detached it from the tree with their forceps, and the little portion thus obtained was then transferred by the first to the second leg, by which it was deposited on the thigh of the third: the farina of plants is collected and transferred in the same manner. This mixture of wax and turpentine did not, however, appear to have been employed in the formation of combs; but only to attach the hive to the board on which it was placed, and probably to exclude other insects, and air during winter. Whilst the bees were employed in the collection of this substance, I had many opportunities of observing the peaceful and patient disposition of them as individuals, which Mr. Hunter has also, in

some measure noticed. When one bee had collected its load, and was just prepared to take flight, another often came behind it, and despoiled it of all it had collected. A second, and even a third load was collected and lost in the same manner, and still the patient insect pursued its labour, without betraying any symptoms of impatience or resentment. When, however, the hive is approached, the bee appears often to be the most irritable of all animals; but a circumstance I have observed amongst another species of insects, whose habits are in many respects similar to those of bees, induces me to believe, that the readiness of the bees to attack those who approach their hives, does not in any degree spring either from the sense of injury, or apprehensions of the individual, who makes the attack. If a nest of wasps be approached without alarming its inhabitants, and all communication be suddenly cut off between those out of the nest and those within it, no provocation will induce the former to defend their nest, or themselves. But if one escape from within, it comes with a very different temper, and appears commissioned to avenge public wrongs, and prepared to sacrifice its life in the execution of its orders. I discovered the circumstance, that wasps thus excluded from their nest would neither defend it nor themselves, at a very early period of my life; and I profited so often, by the discovery, as a schoolboy, that I am quite certain of the fact I state; and I do not entertain any doubt, though I speak from experiments less accurately made, that the actions of bees, under similar circumstances, would be the same.

Mr. Hunter conceived bees-wax to be an animal substance, which exuded between the scales of the belly of the insect; but I am strongly disposed to believe that it is collected from plants, and merely deposited between the scales of the belly of the bee, for the joint purposes of being carried with convenience, and giving it the temperature necessary for being moulded into combs: and I am led to this conclusion, not only by the circumstance of wax being found in the vegetable world, but also by having often observed bees employed in detaching something from the bases of the leaves of plants with their forceps, which

they did not deposit on their thighs, as they do (I believe invariably) the farina of plants. I have also frequently observed the combs of very late swarms to be remarkably thin, and white, and brittle; which are circumstances very favourable to the conclusion, that the wax is a vegetable substance, for it would probably be less abundant during autumn than in summer; and that portion which had remained on the plants till late in the season would hence become more colourless by exposure to light, as well as more dry and brittle than when it first exuded; but were it an animal substance, there does not appear any reason, why it should be more dry and brittle, or less abundant, in the autumn, than in the spring and summer. The conclusions of Mr. Hunter are, however, always drawn with so much caution, and he united so much skill and science with the greatest degree of industry, that it is not without much hesitation and diffidence, that I venture to put my opinion in opposition to his authority.

Elton, May 4, 1807. T. A. KNIGHT.

ON THE UNEQUAL DURATION OF CANDLES.

FROM some recent experiments, it appears "that of all the different sizes of tallow candles, that called 'sixes to the pound' burn longest. A difference has also been found in the length of time which candles of the same size will burn. In one instance it is stated that a mould candle, six to the pound, made in New York, burnt six hours and forty-seven minutes; while one made at Hartford, burnt seven hours and seventeen minutes, making a difference in favour of the latter of one half hour in each candle, or of three hours in the pound." The difference in the qualities of the two candles arose in all probability from the nature of the fat employed in making them. Mutton suet, or the suet of oxen or cows fed with still wash, will not be so hard, and of course will not make such good candles as if the animals had been fed on grass or Indian corn.

PAPERS ON AGRICULTURE.

ON THE CULTIVATION AND MANUFACTURE OF WOAD.

In a letter to the Bath and West of England Agricultural Society.

By Mr. JOHN PARRISH.*

WOAD is a plant which, combined with indigo, gives the best and most permanent blue dye hitherto discovered. It is of great importance to our commerce, as well as to agriculture, being in nature one of the best preparers of land for a corn crop† that has hitherto been discovered; and, if the land is properly chosen for it, and well managed, will be found very profitable, more particularly at this time, when its price is advanced to almost an unprecedented degree: therefore I conceive that in rendering its cultivation and preparation better known and understood, it may be greatly beneficial to the nation.

I have been many years a considerable consumer of woad, and have also cultivated it with much success: and though I am well experienced in the usual method of its preparation, I was induced to depart from it in consequence of the great waste of its juices in the old method of grinding and balling. But I shall endeavour to give instructions for carrying on each process, and leave those who shall undertake it to proceed as they think best.

This plant is cultivated in different parts of England for the use of the dyers, as well as in France, Germany, &c. It is best to sow the seeds in the month of March, or early in April, if the season invite, and the soil be in condition to receive it; but it requires a deep loamy soil, and is better still with a clay bottom, such as is not subject to become dry too quickly. It must never be flooded, but situated so as to drain its surface, that it may not be poisoned by any water stagnant upon it.

If (at any reasonable price) meadow land to break the turf can

* From Vol. XII. of the Society's Letters and Papers. Bath, 1811.

† In England *corn* is the general term for grain of all kinds. *Editor.*

be obtained, it will be doubly productive. This land is generally freest from weeds and putrid matter, though sometimes it abounds with botts, grubs, and snails. However, it saves much expense in weeding; and judicious management will get rid of these otherwise destructive vermin. A season of warm showers, not too dry or too wet, gives the most regular crop, and produces the best woad.

If woad is sown on corn-land, much expense generally attends hoeing and weeding: and here it will require strong manure, though on leys it is seldom much necessary, yet land cannot be too rich for woad. On rich land dung should be avoided, particularly on leys, to avoid weeds. Some people sow it as grain, and harrow it in, and afterwards hoe it as turnips, leaving the plants at a distance in proportion to the strength of the land: others sow it in ranks by a drill-plough; and some dibble it in, (in quincunx form, by a stick with a peg crossways, about two or two and a half inches from the point, according to the land,) putting three or four seeds in a hole, and these holes to be from twenty inches to two feet apart, according to the richness of the land: for good land, if room be given, will produce very luxuriant plants in good seasons; but if too nearly planted, so that air cannot circulate, they do not thrive so well: attention to this is necessary in every way of sowing it. I have been most successful in this last process. Woad very often fails in its crop, from the land not being in condition, or from want of knowing how to destroy the botts, snails, wire-worms, &c. that so often prey upon and destroy it, as well as from inattention to weeding, &c. Crops fail also from being sown on land that is naturally too dry, and in a dry season; but as the roots take a perpendicular direction, and run deep, such land as I have described (with proper attention to my observations) will seldom fail of a crop: and if the season will admit sowing early enough to have the plants strong before the dry and hot weather comes on, there will be almost a certainty of a great produce.

These plants are frequently destroyed in the germination by flies, or animalculæ, and by grubs, snails, &c. as before observed;

and in order to preserve them, I have steeped the seeds with good success in lime and soot, until they began to vegetate; first throwing half a load or more of flour lime* on the acre, and harrowing it in. Then plant the seeds as soon as they break the pod, taking care not to have more than one day's seed ready; for it is better to be too early, than to have their vegetation too strong before it is planted, lest they should receive injury; yet I have never observed any injury in mine from this, though I have often seen the shoot strong. Either harrows or rollers will close the holes. If the ground be moist it will appear in a few days; but it will be safe, and a benefit to the land, to throw more lime on the surface, when, if showers invite snails and grubs to eat it, they will be destroyed, which I have several times found; particularly once, when the leaves were two inches long, and in drills very thick and strong, but the ground was dry. When a warm rain fell, in less than two hours I found the ranks on one side attacked by these vermin, and eaten entirely off by a large black grub, thousands of which were on the leaves, and they cleared as they went, not going on until they had destroyed every leaf where they fixed. They had eaten six or seven ranks before I was called by one of my people to observe it. Having plenty of lime, I immediately ordered it in flour to be strewed along those ranks which were not begun. This destroyed them in vast numbers, and secured the remainder. Another time, having had two succeeding crops on four acres of land, I considered it imprudent to venture another. However, as the land after this appeared so clean and rich, I again ventured, but soon found my error. On examining the roots (for after it had begun to vegetate strong, it was observed to decay and wither) I found thousands of the wire-worm at them, entwined in every root. I immediately strewed lime, (four loads of six quarters each, on the four acres,) and harrowed it; when rain coming on soon after, washed it in, and destroyed them all, and gave me an extraor-

* If the seeds are not sown within a day after the time, it will lose much effect.

dinary crop; but the first-sown side of the field, where they had begun, never quite recovered like the rest. And I am fully satisfied, that when the grub is seen in wheat, &c. the same treatment (if the weather suited) would destroy them all, as well as change the nature of the land. I need not enter on the wide and extensive field of observations on the causes of weeds, grubs, &c. (which so often counteract the labours of the husbandman,) that occur so differently in different seasons, and after different treatment and improper crops—further than to observe, that when your land has *not a proper change*, then it is that these are experienced in a more destructive degree.

Further, it is in vain to expect a good crop of woad, of a good quality, from poor and shallow land. The difference of produce and its value is so great, that no one of any experience will waste his labour and attention on such lands upon so uncertain a produce. Warm and moist seasons increase the quantity every where, but they can never give the principle which only good land affords.

In very wet seasons, woad from poor land is of very little value. I once had occasion to purchase at such a time, and found that there was no possibility of regulating my vats in their fermentation; and I was under the necessity of making every possible effort to obtain some that was the produce of a more congenial season. I succeeded at last; but I kept the other three and four years, when I found it more steady in its fermentation; but still it required a double quantity, and even then its effect was not like that from good woad.

At this time several dyers experienced much difficulty, and one of eminence in the blue trade suffered so much by woad of his own growth, that he declared his resolution to decline the trade altogether. When I pointed out to him that it was the woad that occasioned his bad blues, and that I had from the same defect purchased such other woad as would do, and informed him where he could get it,—he succeeded as usual. His own he disposed of to a drysalter, who sold it again somewhere in the country; and it occasioned such a cause of complaint, as

I believe rendered the claim of payment to be given up, or partly so: of this I am not certain, having it only from report. I mention this in order to give those who wish to become growers of woad, such information as may properly direct them.

The leaves of woad on good land in a good season grow very large and long, and when they are ripe show near their end a brownish spot inclining to a purple towards its centre, while other parts of the leaves appear green, but just beginning to turn of a more yellowing shade; and then they must be gathered, or they will be injured.

Woad is to be gathered from twice to four and even five times in the season, as I once experienced (it was an early and a late season,) and for the next spring I saved an acre for seed, of which I had a fair crop. I picked the young seedling sprouts off the rest, and mixed with my first gathering of what was newly sown; this was very good. During one season I let these shoots grow too long; the consequence was, that the fibrous parts became like so many sticks, and afforded no saponaceous juices. When you design to plant woad on the same land the second season, it should be as soon as your last gathering (before winter is finished) be ploughed; that is, as soon as the weather will permit, and in deep furrows or ridges, to expose and ameliorate it by the vegetative salts that exist in the atmosphere, and by frost and snow. This, in some seasons, has partly the effect of a change of produce; but if intended for wheat, the last gathering should not be later than September.

The land, after woad, is always clean, and the nature of the soil appears to be greatly changed in favour of the wheat crop; for I have always experinced abundant increase of produce after woad, and observed that it held on for some time, if proper changes were attended to, and good husbandry. Keeping land clean from weeds, certainly produces an increase of corn; but in the hoeing and gathering woad (for hoeing and earthing up the plants often renders them abundantly more prolific, even if there are no weeds), many nests of animalculæ are destroyed, as well as grubs and insects, which are destructive to vegetation.

All this is favourable to corn; but I am disposed to believe that woad in itself furnishes such a principle of change in favour of corn (and wheat in particular), as in a high degree to merit the attention of that Society who are so honourably united to promote and encourage the first interests of the British empire.

(To be concluded in the next number.)

ON RAISING NEW AND EARLY VARIETIES OF THE POTATO, (SOLANUM TUBEROSUM.)

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.**

THE potato contributes to afford food to so large a portion of the inhabitants of this country, that every improvement in its culture becomes an object of national importance; and thence I am induced to hope, that the following communication may not be unacceptable to the Horticultural Society.

Every person who has cultivated early varieties of this plant, must have observed that they never afford seeds, nor even blossoms; and that the only method of propagating them is by dividing their tuberous roots: and experience has sufficiently proved, that every variety, when it has been long propagated, loses gradually some of those good qualities, which it possessed in the earlier stages of its existence. Dr. Hunter, in his Georgical Essays, I think has limited the duration of a variety, in a state of perfection, to about fourteen years: and probably, taking varieties in the aggregate, and as the plant is generally cultivated, he is nearly accurate. A good new variety of an early potato is therefore considered a valuable acquisition, by the person who has the good fortune to have raised it; and as an early variety, according to any mode of culture at present practised, can only be obtained by accident from seeds of late kinds, one is not very frequently produced; but by the method I have to communicate, seeds are readily obtained from the earliest and best varieties;

* From the Transactions of the Horticultural Society, Vol. I, p. I, p. 57.

and the seeds of these, in successive generations, may, not improbably, ultimately afford much earlier and better varieties, than have yet existed.

I suspected the cause of the constant failure of the early potato to produce seeds, to be the preternaturally early formation of the tuberous root; which draws off, for its support, that portion of the sap, which, in other plants of the same species, affords nutriment to the blossoms and seeds; and experiment soon satisfied me, that my conjectures were perfectly well founded.

I took several methods of placing the plants to grow, in such a situation, as enabled me readily to prevent the formation of tuberous roots; but the following appearing the best, it is unnecessary to trouble the Society with an account of any other.

Having fixed strong stakes in the ground, I raised the mould in a heap round the bases of them; and in contact with the stakes, on their south sides, I planted the potatoes from which I wished to obtain seeds. When the young plants were about four inches high, they were secured to the stakes with shreds and nails, and the mould was then washed away, by a strong current of water, from the bases of their stems, so that the fibrous roots only of the plants entered into the soil. The fibrous roots of this plant are perfectly distinct organs from the runners, which give existence, and subsequently convey nutriment, to the tuberous roots; and as the runners spring from the stems only of the plants, which are, in the mode of culture I have described, placed wholly out of the soil, the formation of tuberous roots is easily prevented; and whenever this is done, numerous blossoms will soon appear, and almost every blossom will afford fruit and seeds. It appears not improbable, that by introducing the farina of the small, and very early varieties into the blossoms of those of larger size, and somewhat later habits, moderately early varieties, adapted to field culture, and winter use, might be obtained; and the value of these to the farmer in the colder parts of the kingdom, whose crop of potatoes is succeeded by one of wheat, would be very great. I have not yet made any experiment of this kind; but I am prepared to do it in the present spring.

ADDRESS

OF THE CATTLE SOCIETY OF PENNSYLVANIA, TO THE PUBLIC.

THREE years have now elapsed, since the Cattle Society of Pennsylvania was formed, and they are gratified in finding that their services to their country have met with a general acknowledgment, in consequence of the attention they have excited to the important subject which is the object of their deliberations. With the design of giving the zeal of their farming fellow-citizens a right direction, they published soon after they associated, an address, stating the necessity for establishing the Society, its objects and views, and offered sundry premiums for subjects, which, from their knowledge of the country, appeared of primary importance. Among these are the importation of certain well known breeds of cattle, possessing the all-important qualities of early maturity, of speedy fatting, or of rich milk; and the origination of similar breeds by selection from, or judicious crossings with, our domestic stock. It must be also acknowledged that they offered premiums for cattle of extraordinary weights of flesh and fat, and although they were aware that this measure laid them open to the censure of continuing a practice which has been abandoned by European improvers from discovering the errors that it led to, yet they may plead in excuse, their knowledge of the existence in different states at the time of some very large cattle, and they were desirous of knowing the extent of their capabilities; but in a general way, the society are convinced of the impropriety of encouraging farmers to keep cattle until over ripe, they being neither profitable to the feeder, nor essentially requisite for the purposes of life: two of the premiums last alluded to, have been awarded to citizens of New-Jersey ;* and the

* For the particulars of the weights of those extraordinary large and fat oxen, see the "ARCHIVES OF USEFUL KNOWLEDGE," Vol. 1, p. 61, and Vol. 2, p. 61.

The Cattle Society bears the name of "*Pennsylvania,*" but they consider their premiums as open to the *inhabitants of the whole Union,* provided the cat-

subjects of them, while they constitute specimens of superior weights of flesh and fat, which it is confidently believed HAVE NEVER BEEN EQUALLED IN ANY COUNTRY, are also sufficient to prove the absurdity of that most absurd of all prejudices entertained by European writers, respecting the diminutive size of the animals of North America, when compared with those of Europe. So far, therefore, those premiums have not been unproductive of a good effect.

The Society conceive that it is now time to declare more fully their opinions on the subject for which they associated, viz.—*the improvement of the breed of cattle.*

The object of all grazing, of all farming, is profit—and this (as respects the first mentioned calling) they are decidedly of opinion is most effectually promoted, if beef be the object, by breeding or feeding animals of middle size (say from 700 to 1000 weight of beef) whose bodies are capacious, but barrel-shaped, backs straight, loins broad, head and neck small, chines full, leaving no hollow behind the shoulders; chaps clean, with bright and prominent eyes, and whose chests are deep, and project well before the legs; fore legs clean, straight, and standing wide; not knock-kneed (or in-kneed) hips wide and round; rump lying in a horizontal direction, *not sinking backwards;* the tail set on so high as to take in the same line with the back; and lastly, with small bones.* Animals of such forms will readily fatten to the above weights, and upwards, and lay the fat on parts that sell for the most money; and if properly attended to, and well supplied with food, will be fit to turn off in one season, when grass is done, and do credit to any market. Whereas, on the contrary, very large animals cannot be brought to market without three or four months, nay six months stall feeding, and this too, after two or more seasons of grazing; for all which, the

tle, which are the objects of those premiums, are either killed in Philadelphia, or sold, or kept in Pennsylvania. The funds, as yet, have exclusively been derived from Philadelphia, and its vicinity.

* The portrait of a Teeswater Bull, Vol. 1, p. 358, of the Archives, may be considered as a model of perfection in Cattle.

owner, however gratified his pride may be by the production of such cattle, is seldom if ever reimbursed, and certainly never to the same extent, as if his capital, time, grass, and short feed, had been divided among animals of a smaller size. The object moreover, of all societies for improvement, should be rather to encourage persons to excel in their usual course of profitable pursuit, than to stimulate to over exertion, in the production of a single article, which does not admit of being introduced into general practice, or of setting an example that cannot be followed by the calling at large.

The foregoing remarks apply in the utmost latitude to sheep; and with respect to these, the society cannot with too much earnestness press their fellow farmers to abandon the practice of breeding from the common rams of the country, which are destitute of a single quality that entitles them to attention; but to resort to breeds which combine quality of wool with sweetness of flesh. For these qualities the *new Leicesters*, the production of the preseverance and genius of *Bakewell*, have been famous among other English breeds, for nearly half a century; and fortunately for this country, they partially exist in the utmost purity, and are also extensively diffused in various degrees of blood, throughout the states of Pennsylvania and New-Jersey.*

It has also been left for the spirited farmers in certain parts of those states to prove to what an extraordinary extent the same quality is possessed by the Tunis Broad-tailed, or Barbary sheep, the merits of which are particularly well known in the Philadelphia market.† The experience of the same states too, and of England likewise, has fully, repeatedly shown, that a cross of the

* Some of this breed have been occasionally brought to the cattle shows at Philadelphia, and have never failed to excite expressions of admiration in every beholder, by reason of their beauty.

† So well convinced are the butchers of the value of this breed, that they have been in the practice of purchasing rams, and of presenting them to farmers, merely to secure their produce to themselves, which they bought at generous prices. For an account of the Tunis Sheep, see the *Memoirs of the Agricultural Society of Philadelphia.*

merino with other breeds, not only effects an improvement in the wool, but also in the quality of the meat, and it is a fortunate circumstance that the unexpected multiplication of those precious animals by importation during the years 1810 and 1811, enables every farmer in the United States to possess himself of a ram of some merino blood and at a price little beyond that of common sheep, or of the use of a full bred merino ram, for a sum which cannot be an object with any one desirous of improving his flock.

In a country, the animal and vegetable produce of which is so infinitely beyond its internal consumption, and upon which the European world is obliged to depend for a steady supply for provisions to support their fleets, armies, and colonies, the improvement in the breed of *Swine* holds a rank in point of importance fully equal to that of horned cattle. For this reason, the society, when preparing their premiums, did not omit to call the attention of farmers to the subject; and they are pleased to notice that the superiority of a cross of the African or Guinea* breed of hogs, with the numerous varieties of other breeds, in the great requisites of early maturity and disposition to fatten easily, has occasioned that mixture to be extensively diffused throughout the states of Pennsylvania and New Jersey. The success that has attended the experiments of some of the members of the society with this breed, authorizes them to declare, that by due attention to the selection of well formed females, a degree of perfection may be obtained that renders all attempts at further improvement unnecessary.

The state of our political relations with England and France, for some years past, has prevented the exertion of that enterprise which the society were informed was about to be put in action on the publication of their premiums; and sufficient time has not since elapsed to prove what are the results of any steps that may have been taken to originate in our country, the breeds of cattle

* This breed, which is not to be confounded with that of *China,* is called commonly the "no bone breed," on account of the very small size of the bones.

possessing properties to which the society called the attention of the American cultivator; but they beg leave again to urge the attempt of producing them, from a conviction of the practicability of the measure arising from the existence of the necessary materials among us, the congeniality of climates, soils, and abundance of food in the United States; that the most ample remuneration will reward the expense of time, labour, and capital, and that the solid prosperity of the country will be promoted by the successful issue of the enterprise.

LAWRENCE SECKEL, *Pres't.*

April 16, 1812.

SEVENTH CATTLE SHOW.

THE seventh show, held under the direction of the Pennsylvania Society, for improving the breed of cattle, took place on Thursday, the 30th of April, and Friday, the 1st of May, at Bushhill.

The following cattle were exhibited:

1. By Mr. Shaffer, thirteen handsome and very fat cattle, and a very superior spayed black heifer, all from near Reading, in Berks county. They would have done credit to any country: the heifer brought to the recollection of some persons, the beautiful animal of the same description, exhibited by Mr. Dubs at the first cattle show in July 1810, and on inquiry it appeared that both came from the same farm.

2. By Mr. Shep, four steers, from three to five years old, and a spayed red heifer, all of excellent forms, capacious bodies, and in high order. Their weights of beef were estimated at from 800 to 1200 lbs. The great weight of such young cattle justly excited the attention of the grazing gentlemen present, being an approach to one of the great points that ought to be kept constantly in view in breeding cattle, viz. early maturity. These cattle were fed by Mr. Shep.

3. By Mr. M'Caskey, eight fat steers, two fine milk cows, and 35 sheep, from Lancaster county.

4. By Mr. J. Sill, 10 fat cattle, 1 cow and calf.

5. By Mr. Jacob Ridgway, a young bull calf nine months old, and well grown; the produce of a bull and cow imported from Holland. The sister of this calf, when two months old, was said to have sold for $35.

6. By Mr. Savin, from Kent county, Maryland, three fat oxen.

7. Mr. Barney, at the request of the society, brought a ram and three ewes of the new Leicester breed, being part of those he bought last autumn show. One of the ewes had a lamb six weeks old, for which 4 dollars 50 were offered by a butcher.

8. Mr. R. E. Smith, again showed two rams of the new Leicester breed, exhibited last autumn. Both those lots were admired by all who saw them; their bodies were completely enveloped in good long wool, and showed their naturally rotund forms to great advantage. Such animals cannot be too often seen in public, as they afford a lesson from which our farmers should profit. This lesson has been learnt by some of them, and the benefit derived from it has been amply felt.

9. Mr. James Caldwell brought 20 yearling merino rams and ewes, full blood, which served to keep up the reputation he has so deservedly acquired, as a breeder of this invaluable stock. Their fleeces entirely covered their bodies, and the quality and quantity of the wool, and the sizes of the animals bore the best testimony of the excellence of the stock, and of their *uniform good keep*. They were sold for cash at $45 per piece, to one gentleman, and destined for Ohio.

10. Mr. Bakewell, from near Norristown, brought several pigs, of the Berkshire English breed. The merits of this breed, in attaining great size, upon good keeping, (for which they are said to pay well) is well known in England. Mr. Bakewell has found a cross between this stock, and the African or *No-bone* breed, advantageous: the produce attaining speedily to desirable sizes, and taking on fat speedily.

11. Dr. Logan brought his fine Stud Horse Eclipse, whose sire and grand sire were also raised by him. Eclipse is now nine years old, a dappled brown, of excellent figure. His sire was Highflyer, from a full bred stock of mares of the true English Hunter breed, imported by the late Mr. Penn.

12. Mr. Dubs brought a fine Colt from the well known horse Hickory.

13. Dr. Logan brought a scarifier with five Shears, for pulverising ground, and cutting up surface weeds. It is made after the pattern of Mr. Cook, of England, and has been used with excellent effect during the last year.

14. Mr. Smith, of Bucks county, brought some of his excellent ploughs, which however were not tried, their merit being well known. Some of them were sold for 14 dollars.

The next Show will be held in the autumn, of which timely notice will be given.

ENGLISH PRIZE CATTLE.

[The following account of the Stock that gained the prizes at the Smithfield Show, is taken from the London Monthly Magazine of April 1812. It is addressed to the Editor of that miscellany by the secretary of the club.]

DEAR SIR,

THE Smithfield Club, instituted in the year 1798, for the purpose of ascertaining, by an annual exhibition, *what breed of oxen, sheep, and pigs, will improve the most in weight of meat, for the market, in a given time, and with a given consumption of food*, distributed their annual prizes in December last, on the award of Mr. Thomas Dalby, of Grubb-street, London, Mr. Robert Hughes, of Salthrop, Wiltshire, and Mr. Thomas Stone, of Barrow, Leicestershire, the three judges appointed for examining the many fine animals exhibited, and of weighing the se-

veral particulars in certificates of their breeds, ages, food, &c. Below is a return of the particulars:

PRIZE OXEN.

	Beef.	Loose fat.	Hide, &c.	Head.	Fat.
Mr. John Ellman, jun. 4 year old Sussex ox, worked 4 years, and fed on grass, hay, and 1001 lbs. of oil cake, . . .	1206	180	112	51	32
Mr. Henry King, jun. 3 year old Durham ox, fed on 7½ hundred of hay, and 320 lbs. of oil cake, ...	1245	136	116	56	30
Mr. John Warmington's 4 year old Hereford ox, fed on grass, hay, and turnips, ...	1239	126	141	52	29
Mr. Michael Buckley's 3 year old Devon ox, fed on grass, hay, cabbages, and turnips, ...	842	107	76	21	18
His grace the Duke of Bedford's 4 year old West Highland ox, fed on grass, hay, and turnips, ...	538	74	56	28½	14
Mr. Robert Master's 4 year old Scotch ox, fed on grass, hay, and turnips, ...	734½	90½	64	38½	17

		Mutton and head.	Loose fat.	Skin.	Live weight.
		lb.	lb.	lb.	lb.
Mr. Thomas Plasket's three 20 months old New Leicester wethers, fed on grass and cake,	1st.	119	11½	15	171
	2d.	116	10	15½	165
	3d.	124	12½	16½	181
Mr. James Parson's three 20 months old New Leicester wethers, fed on grass and turnips.	1st.	159½	16½	19	219
	2d.	149	15½	18	205
	3d.	137	12	16	189
Mr. John Boy's three 33 months old wether sheep, fed on hay and green vegetable food.	1st.	96	14	12	144
	2d.	105½	16	19	160
	3d.	116	19	14	168
Mr. John Warmington's three 19 months old Southdown wethers, fed on grass only.	1st.	92	15	12	135
	2d.	90	12	11	133
	3d.	87	10	13	128

PRIZE PIG.

Mr. William Hayward's 50 weeks old pig, fed on barley meal, mixed with the water from the spirit-grains from his brew-house:

Pork and head.	Loose fat.	Feet.	Live weight.
258 lb.	8 lb.	3½ lb.	304 lb.

(Signed) JOHN FAREY, Secretary.

Westminster, Feb. 14, 1812.

REMARKS.

Of the oxen, only the two first were fed on what may be called *extra feed*, viz. oil cakes, which are dear, and as in the case of stall feeding with Indian corn meal, take from the profit. The grass and hay, it may be supposed, were raised on the farm, and were no doubt consumed with advantage by the animals. The weights of all of them are certainly respectable, and they must have been very much disposed to take on fat and flesh, to die as they did. Two or three reflections which occur on this occasion, it is presumed will strike every intelligent American grazier. The Scotch ox, fed by the duke of Bedford, although small, may have proved as profitable as the larger animals, owing to the speed with which that breed fattens, and on that account, as stated upon a former occasion, it is much esteemed in England. The Scotch breed of oxen, (or Kyloes) would be a great acquisition in the United States, as they are extremely hardy, being raised in the inhospitable climate and on the scanty food of the Highlands of Scotland, and when removed to the rich pastures of the lowlands, or of England, thrive rapidly. This breed would bear well the cold in the breeding districts of our new settlements, and on good grass would be fat in July or August; a time when the stall-fed cattle are all killed, and the larger grass-fed beef is not yet fat.

The weights of the sheep deserve attention from the American farmer. It is by feeding such sheep that he would find his account. Indian corn not being required to fit them for market.*

IN order to judge of the comparative profit of feeding two breeds of sheep, the following statement of the weights of seven sheep of the Irish breed is given. They were raised and fed by Francis Hickman, of Chester county, Pennsylvania, and killed in March 1812, by Joseph Groffe, of Spring Garden.

	Skin.	Fat.	Meat.
	lbs.	lbs.	lbs.
1.	15	26½	115
2.	20	25	149
3.	16½	23½	133
4.	15½	34¼	139
5.	19	22	105
6.	15¼	21⅓	120
7.	16	27	115

The precise cost of feeding the above sheep, cannot at present be ascertained. Indian corn, oats, and hay, were however given in abundance, besides pasture for two or three years. If the facts can be procured they shall be given hereafter.

On the stall they appeared covered with fat; so fat indeed, that it was difficult to find any flesh, and no greater proof could be required of the absurdity of a system of cramming, requisite to produce such over ripe animals. One leg weighed 19 lbs.!

* See Vol. 2d, p. 285, for weights of other New Leicester Sheep.

WEIGHTS OF MERINO FLEECES.

George-town, Kentucky, April 29, 1812.

ON Tuesday last, William Story, of George-town, sheared, of the flock belonging to Story and Nichols, 16 full-blooded Merino sheep; 10 of which were imported from Spain. The product was as follows:

	lb.	oz.
A ram, Judas, . . .	12	4
A ram, Don Carlos, . . .	9	12
An imported ewe, . . .	7	
Do. do. . . .	7	8
Do. do. . . .	7	8
Do. do. . . .	10	4
Do. do. . . .	8	4
Do. do. . . .	8	
Do. do. . . .	6	12
Do. do. . . .	6	4
A ewe lamb, Sancho, 15 months old, .	9	
A ram, Palafox, . . .	8	8
A ewe lamb, ...	7	8
A young ram, Columbus, 10 months old,	7	
A young ram, " " .	5	
A young ewe, about 10 months old, .	5	4
	125	12

Averaging the flock, including the lambs, about 7 lb. 14 oz.

The above shearing was attended by about one hundred persons.

It is not stated whether the above sheep had been washed previously to shearing. If they had not, some allowance must be made for loss in weight: even with that deduction, their weights were respectable.

Information received by the Editor from several gentlemen in Pennsylvania, New Jersey, and Delaware, enables him to state that Merinos yield 7½, 8, 8½, and 9 lbs. wool; the animals having been previously washed.

DIRECTIONS HOW TO MAKE HOUSE-LAMB.

THE business or art of making house-lamb, has been studiously kept secret, or known but to a few, in England, or elsewhere: hence we see no mention of it in any of their books of agriculture; and hence the ignorance in this particular, of both the gentleman and common farmer.

Those near London, who wish to have lambs *marketable* by Christmas, January, or February, are in the practice of art, to induce their ewes to take the ram, at an earlier season than nature dictates; this with us, is on the approach of our early frosts, so that our lambs fall, usually, from January to March, inclusive; and it is nearly the same in England. Hence grass lambs are seldom *marketable*, until May and June. This accounts why house-lamb commands at the London market, (and proportionally in Philadelphia) a guinea a quarter at Christmas; half a guinea, after the holidays; an English crown in February and March; and, on the appearance of grass-lambs in April, May, and June, the price is gradually reduced to half a crown.

To make, or fatten house-lamb for the market, let your ewes be well attended to, and fed upon a patch of rye, or rape, sowed early for the purpose; upon turnips or other corresponding food; affording abundant milk: as fast as your lambs fall, and can run well alone, all you have, are to be shut up together in a dark pen or stall, of proportionate size to the number of lambs you expect, having a narrow trough, breast high to them, to be daily supplied with Indian corn meal, with the bran in it; and hanging up, within their reach, one or more wisps or small bundles of fine hay for them to nibble at. This stall must communicate with, or adjoin, a larger apartment, into which you are to turn ewes twice or thrice a day, to suckle their lambs; and to sleep all night with them. Before turning the ewes out to pasture, each time, the lambs must be lifted into their small dark pen or stall, where they will have no room to skip or play their fat away:*

* A pen or stall, 6 or 8 feet square, is sufficiently large for thirty lambs or more.

here they will nibble so much of the fine hay, and eat so much of the dry Indian corn meal, from want of other employment, as to render themselves voraciously thirsty against the next meal of milk from their dams; which, with the other causes mentioned, makes them grow surprizingly large and fat in a short time. Lambs thus educated, will often promiscuously suck the ewes, without knowing or being attached to their own dams.—Hence a very great advantage: for when all grow large and strong, they become capable of consuming more milk than a single ewe can afford; and more especially those ewes which have two or more lambs each. For upon killing off all the lambs of a ewe, that ewe continues to give suck to the other lambs promiscuously as before, to the great advantage of the surviving lambs, now requiring additional nourishment. This is not the case when lambs run out at large with their dams.

As the intelligent practical farmer will readily see how advantageously he may adopt this management in rearing his *early* lambs, further directions will be useless: all who shall adopt it will unavoidably improve his breed of sheep, provided they sell off or kill their *late* instead of their *early* lambs, as is the general custom of farmers.

TO MAKE FAT AND WHITE VEAL.

THE calves, as soon as capable of running, should be shut up in a dark warm pen, or stall, in the manner directed for lambs; with a small manger, breast high, in which unsifted Indian corn meal should be given to them daily, in such quantities only as they will consume; with a small bundle of fine hay tied up, and a lump of chalk within their reach. The licking and eating of these, will create an increased appetite for the cow's milk, and contribute so much to fatten them as to make infinite difference in the growth and goodness of the veal; and their confined state will prevent their running their fat and flesh away. By licking the chalk, acidity, which often causes a loseness, is pre-

vented. A pen or stall eight or nine feet square, is sufficiently large for six or nine calves. The pen must be kept very dry and clean. By a strap round the neck, they should be led morning and evening to suck the cows, chained in their respective stalls, and then led back to their own. In this manner, calves may be taught to suck other cows than their dams; but this is seldom necessary where cows are properly fed, except where you wish to make an extraordinary sized calf, by keeping it a week or two longer than usual. The cows should be well fed upon good hay, and pumkins, and boiled or steamed potatoes, mashed and mixed with hay tea, to which a handful of ground linseed cake, or some flaxseed jelly, may be occasionally added. If the hay has not been salted when housed, or stacked, a handful of salt should be given twice a week. The hay tea is most profitably made, by collecting the blossoms and leaves of clover from the barn floor, barn entry, or from the horse troughs, and after putting them in a tub, by pouring boiling water on them. Cows are very fond of the water, and by sprinkling a handful of corn meal over the blossoms after they have drank it up, they will freely eat them.—To make veal white, bleed calves in the neck every third day, in clear weather, during the third and fourth week, until the calf is nearly faint, which may be known by its eyes. These bleedings should be in the middle of the day, after the calf has nearly digested its morning's meal. No animal is more subject to a plethora, or too much fullness, than calves; they therefore bear bleeding well. On this account also, they should be moderately fed at first, and blood must be taken away whenever they loathe their food.

PROFITABLE COW.

[The following account of the produce of the third and fourth years of the cow mentioned in vol. 2d, p. 399, is taken from a recent British agricultural publication.*]

THE cow calved April 6th, 1807, and the calf was sold at fourteen days old. From that time to the 4th of February 1808, the produce was,

	£.		
Butter 675lbs. and sold for - -	49	9	2
The milk produced was 5782 quarts, of which 5107 quarts sold at 1*d.* skimmed,	21	5	7
The calf at 14 days old, - - - -	2	12	6
The manure, - - - - -	3	0	0
Total produce, £.	76	7	3
Deduct expenses,	24	14	2
Neat profit, - £.	51	13	1

The fourth year, 1808, she calved on the 23d April, and up to the 13th February 1809, she gave as follows:

	£.		
Butter 466lbs. and sold for - -	34	5	0
Milk produced was 4219 quarts, of which 3753 was sold at 1*d.* for - - -	15	12	9
The calf at 17 days old, - - -	1	16	0
The manure, - - - - -	3	0	0
Total produce, £.	54	13	9
Deduct expenses,	24	14	2
Neat profit, £.	29	19	7

* Agriculture defended by Philarator, p. 71, London, 1811. The statement is taken from the Commun. to Board of Agriculture of London.

The neat profit of this valuable cow in five years was as follows:

1st year,	£.	42	15 1
2d year,		30	16 1
3d year,		51	13 1
4th year,		29	19 7
5th year,		59	17 0
	£.	215	0 10

No one will deny that this profit is very great, and the above statement proves incontestibly, that a good milch cow pays a great interest for the extra food allowed her.

The following account on the profit of the dairy is taken from the work last quoted.

"There lives in Somersetshire, a widow, who rents fifteen acres of good meadow, at £.4 per acre; on which she keeps ten cows. She has no other concern, yet she sells annually from these ten cows, to one dealer in Bristol, regularly 6000 lbs. of cheese: and avows that her average income from her little dairy is £270, and she accordingly pays income tax on that sum.

Statements of the Dr. and Cr. of American dairies would be acceptable.

PAPERS ON THE USEFUL ARTS.

OBSERVATIONS ON THE PRESENT STYLE OF AMERICAN ARCHITECTURE, WITH A PLAN FOR IMPROVEMENT.

IN a conversation with Mr. Fulton on this subject, he dwelt on the irregularity of the style of building houses in cities in the United States, and the superiority of the colonnade principle, and offered the annexed plan of a row of houses, to illustrate his objections, and intended substitute. In a letter accompanying the draught he observes,

" As to our mode of building, there is much room for improvement. Our ancestors built such houses and streets as they were accustomed to see in Europe a century ago; and our masons and carpenters by habit continue the imitation. Hence we have, even sometimes within one hundred yards of length, in the same street, high steps, low steps, no steps, porches, no porches, cellar doors of 30, 40, and some 50 degrees elevation: and hence in the first place irregularity, confusion, nooks and corners for dirt. The width of the pavement is diminished, and the clean and uniform lines which give a grandeur to architecture, are destroyed. Added to these evils, no thought has been given to shelter us from the snow, and cold rains of winter, or the burning sun, and violent rains of summer.

" I here give you a sketch of two streets, each 35 feet wide, from front to front of the houses. (See the plate.) AA, is our present mode of building steps, occupying half of a narrow pavement, and offices X half under ground; a person on a bad pavement exposed to a burning sun, BCC, rain or snow. D shows a street of the same width, with the proposed improvement, viz. by placing the pavement under the building, and supporting the fronts of the houses by a colonnade or arcade. This much taken out of the under part of the front of a house, could, if required, be given in depth under a piazza projecting into the yard. Thus foot passengers would be under cover, offices above

ground, and cellars under offices; cellar doors as at EE, near the curbstone, the line of pavement straight and neat, and easily kept clean. This would not only be a very convenient mode to widen narrow streets by degrees, as buildings are pulled down and rebuilt, but where streets are wide the fronts might come over the pavement. In considering this mode of building, I am convinced you will see all the numerous elegancies and conveniencies which would result from it. It is moreover as cheap as the common mode of building; the steps and rails costing at present as much as the columns."*

At Chester, in England, it is said† the foot passengers walk through the fronts of the first floors of all the houses, under colonnades, with shops on the one hand, and pleasant balconies on the other, and it is remarked that nothing can be more commodious, pleasant, sociable, and picturesque; a delightful walk is afforded by the arrangement in all weather, trade is rendered subservient to luxury in the preservation of the spacious walls of the houses, and luxury repays trade for the accommodation, by the rows, or by what in Covent Garden would be called the Piazzas, or at Tunbridge the Pantiles.

In the city of Bologna, in Italy, in all the principal streets, and many of the lesser ones, the colonnade principle is adopted.

The idea of a colonnade, suggested by Mr. Fulton, was projected several years ago by Mr. Mills, architect, now of Philadelphia, when engaged in the design for the Scots Church in Charleston, S. C., but was not carried into effect. The propriety of a covered walk round the building occurred to him, without having any previous knowledge of its being introduced elsewhere. In a climate like that of S. Carolina, the advantages of such a walk would be sensibly felt, and there is scarcely any building whether public or private, but would afford more or less

* A very neat model in mahogany of a row of houses upon the above plan, was sent by Mr. Fulton to the Editor, who has deposited it in the *Academy of Fine Arts*, Philadelphia.

† Monthly Mag. London, April, 1812.

comfort from the possession of it. Besides providing for such a walk, the arcade intended to constitute it, by forming the support of the galleries, would have freed the nave of the church from interruption of columns (necessary to the support of galleries in the usual way) thereby producing a finer relief to the room; and the walls below being sheltered from the sun's rays by the projection of the galleries externally, would have prevented the accumulation of heat.

The architecture of the United States is certainly improving: one mark of a disposition to improve in any branch is a change from former habits, and in Philadelphia, at least, this is perceptible to all within a few years, in the buildings.

The style of building (called the Basement plan) which places the offices upon the first floor, has been successfully introduced in Philadelphia, in several instances by Mr. Mills. The two first houses executed upon this plan, are on Chesnut street, at the South West corner of seventh street. The westernmost exhibits the best specimen, as it has more front. The entrances are sheltered by circular porticoes. The next instance of the basement plan is in Washington Square, Locust street front, between ninth and tenth streets, in four houses, twenty-eight feet front each. These recede from the line of the street eighteen or twenty feet, which space is to be inclosed by a palisade fence, and laid out in grass and shrubbery. A colonnade will extend the whole front of the building, which, whilst it affords below a shelter to the inhabitants from the rain and sunbeams, provides a balcony above for the display of shrubbery, and affords a promenade during the shady hours. It may be observed, while speaking of these buildings, that much credit attaches to the proprietors* of the square on which they are built, for the judicious arrangements and spirited improvements they have and are making on this square, which promises to be the handsomest in Philadelphia.

* Messrs. Meany and Savage, merchants.

As connected with this subject, the following remarks on the CONSTRUCTION OF CITIES deserve serious attention in the United States. The ideas, and the facts on which they are founded, are perfectly correct, and it is to be much regretted, that an attention to wealth, instead of the public health, should operate to prevent the general adoption of the plan suggested.

Extract of a letter from Thomas Jefferson, to William C. C. Claiborne, governor of Orleans territory, dated Washington, July 7th, 1804.

" The position of New Orleans certainly destines it to be the greatest city the world has ever seen. There is no spot on the globe to which the produce of so great an extent of fertile country must necessarily come: it is three times greater than that on the eastern side of the Alleghany, which is to be divided among all the sea-port towns of the Atlantic states. There is also no spot where yellow fever is so much to be apprehended. In the middle and northern parts of Europe, where the sun rarely shines, they can safely build cities in solid blocks without generating disease. But under the cloudless skies of America, where there is so constant an accumulation of heat, men cannot be piled upon one another with impunity. Accordingly we find this disease confined to the solid built parts of our towns, and the parts on the water side, where there is much matter for putrefaction, rarely extending into the thin parts of the town, and never into the country. In these latter places it cannot be communicated; in order to catch it you must go into the local atmosphere where it prevails. Is not this then a strong indication that we ought not to contend with the laws of nature, but should decide at once that all our cities shall be thin built? You will perhaps remember, that in 1793, yourself, the present governor Harrison, and some other young gentlemen, dining with me in Philadelphia, the then late yellow fever being the subject of conversation, and its incommunicability in the country, I observed that in building cities in the U. States we should take the chequer board for our plan, leaving the white squares open and unbuilt for ever, and

planted with trees. Harrison treasured this idea in his mind, and having to lay off a city two or three years ago on the banks of the Ohio, he laid it off on this plan. As it is probable New Orleans must be very soon enlarged, I enclose the same plan for consideration. I have great confidence that howsoever the yellow fever may prevail in the old part of the town, it would not be communicable in that part which should be built on this plan; because this would be all like the thin built parts of our towns, where experience has taught us, that a person may carry it after catching it in its local region, but can never communicate it out of that. Having very sincerely at heart that the prosperity of New Orleans should be unchecked, and great faith, founded as I think in experience, of the effect of this mode of building against a disease which is such a scourge to our close built cities, I could not deny myself the communication of the plan, leaving it to you to bring it into real existence, if those more interested should think as favourably of it as I do. For beauty, pleasure, and convenience, it will certainly be eminent."

PROCESS FOR PROVING THE QUALITY OF A GLAZE OF EARTHENWARE.*

THE glaze of earthenware may have several defects: it may be scratched more or less readily by a hard body; weak acids, such as vinegar, lime-juice, verjuice, &c. may attack and dissolve the lead it contains, or oily substances standing long on it may produce the same effect, stain it and render it dull.

To determine its power of resisting friction, it may be rubbed with sand, and if this scratch it more readily than it does a glaze known to be good, we may be assured it is soft.

If vinegar be boiled for some hours in a vessel coated with a soft glaze, it will attack the glaze, and dissolve a portion of its

* Sonnini's Bibliothèque Phisico—Economique, July 1807, p. 43.

lead, which will be precipitated from the vinegar on the addition of a few drops of sulphuric acid, commonly called oil of vitrol.

But a method more within every one's reach, therefore deserving to be known, is, to let fall a drop of strong ink on a piece of earthenware, dry it before the fire, and then wash it: if the glaze be too soft, the ink will leave on it a slight spot.

A full description of the method of preparing Mr. George Blackman's superfine oil-colour cakes; as communicated to the Society for the encouragement of Arts, Manufactures, and Commerce, London, and practised by him in presence of a committee appointed by the society to ascertain the merit of the invention.*

TAKE of the clearest gum mastic, reduced to fine powder, four ounces; of spirit of turpentine, one pint; mix them together in a bottle, stirring them frequently till the mastic is dissolved: if it is wanted in haste, some heat may be applied; but the solution is best when made cold. Let the colours to be made use of be the best that can be procured, taking care that by washing, &c., they are brought to the greatest degree of fineness possible. When the colours are dry, grind them on a hard close stone (porphyry is the best) in spirit of turpentine, adding a small quantity of the mastic varnish: let the colours so ground become again dry; then prepare the composition for forming them into cakes in the following manner:—Procure some of the purest and whitest spermaceti you can obtain; melt it over a gentle fire, in a clean earthen vessel; when fluid, add to it one-third of its weight of pure poppy oil, and stir the whole well together: these things being in readiness, place the stone on which your colours were ground on a frame or support, and, by means of a charcoal fire under it, make the stone warm; next grind your colour fine with a muller; then, adding a sufficient quantity of the mixture

* From the twelfth volume of the Transactions of the Society, who voted the greater silver palette and twenty guineas to Mr. Blackman, for discovering his process for the use of the public.

of poppy oil and spermaceti, work the whole together with the muller to a proper consistence; take then, a piece of a fit size for the cake you intend to make, roll it into a ball, put it into a mould, press it, and it will be complete.

When these cakes are to be used, they must be rubbed down in poppy or other oil, or in a mixture of spirit of turpentine and oil, as may best suit the convenience or intention of the artist.

The abovementioned oil-colour cakes were tried after they had been in the possession of Mr. Cosway and of the Society for twelve months, and were found to possess the same valuable properties they had at first.

Mr. Cosway says, that he made several experiments with these colours, and is of opinion that the manner in which they are composed is a new and useful discovery; and the great advantage they possess of drying without a skin on the surface, is a a very essential improvement on the usual mode of oil-painting, particularly for small works.

Mr. Stothard says, one advantage these colours possess above others is, they must be very convenient to travellers, as they are always fit for immediate use, they not drying hard nor skinning over.

Mr. Abbot says he has frequently used colours prepared by Mr. Blackman, particularly his red lead, which, as far as he can judge, is better preserved from changing by this method of preparing, than by any other he has met with; and as the tint given by red lead is peculiarly adapted to the highest lights of flesh, more especially on the forehead in portrait-painting, he thinks Mr. Blackman's discovery, if it fully answers that purpose, a very advantageous one to artists; that he has so good an opinion of Mr. Blackman's ingenuity and merit on this head, that he has ordered a set of colours prepared in his manner, in bladders, for his own use.

N. B. It may here be proper to observe, that Mr. Blackman's colours in bladders are prepared with a mixture of spermaceti, and differ from his cakes only in having a larger proportion of oil.

TO FIX CHALKS ON BROWN OR COLOURED PAPER.

In reply to a query on this subject in the London Monthly Magazine, the following method is given, in the same Magazine for April, 1812.

DIP the drawing into a vessel of cold water, large enough to admit it with ease; and then put it under the roller of a mangle, with a sheet of paper over it, and turn the mangle with no more than sufficient force to smooth it: this will at once communicate a very faint impression of the drawing to the blank paper, and fix the chalks for ever after.

ON THE MANUFACTURE OF SALT PETRE.*

AMONG the numerous and diversified blessings which Providence has conferred upon the United States, calculated to render them independent of the whole world, the abundance of nitre in caves, and in the soil of Kentucky, Tennesee and Virginia, is of the first importance at this time, when the injustice of foreign governments has forced us to assume a warlike attitude, and the energies of the nation are about to be called forth: and as it is believed that the process adopted in the refining it is far from perfect, the following account of the salt, and of the improved mode adopted in France to prepare it, will, it is hoped, be attended with the wished-for utility.

EDITOR.

SALT PETRE, NITRE, or chemically speaking, NITRATE of POTASH, is a neutral salt composed of nitric acid and potash in a state of mutual saturation. Its primitive crystalline form is that of a rectangular octohedron, composed of two pyramids, applied base to base, in such a manner that two opposite sides of the upper pyramid form with the corresponding sides of the lower one angles of 120°, while the two other opposite sides form with the corresponding ones angles of 111°. This figure how-

* From Aitkin's Chemical Dictionary.

ever is of very rare occurrence. When the summits of the pyramids are deeply truncated, the result is a bevelled rectangular table, which is by no means unfrequent. But the most usual form which this salt assumes, is that of the common quarts crystal, viz. a straight six-sided prism, terminated at each extremity by a six-sided pyramid.

Nitre may be considered both as a natural and artificial product. Native nitre, mineralogically speaking, is a substance of very recent formation. It appears to occur in two different repositories: the first of these is limestone, and the second is vegetable soil. The calcareous repository is either a peculiar variety of secondary floetz-limestone, or calcareous tufa, or chalk, or indurated marle. In these rocks it occurs as a thin granular crust, or an efflorescence of minute spicular crystals over-spreading the outside, and particularly lining the inside of the caverns both natural and artificial, with which these rocks abound. Hence probably is derived its ancient name, saltpetre, (*Sal Petræ*, Rock Salt.) Calcareous strata containing nitre, are found in various countries.

In many nitrous soils the acid which they contain is combined for the most part with lime instead of potash, so that the produce of real potash, which they afford by the usual mode of treatment is very small. Long experience, however, has taught the nitre-makers in every country where these soils occur, to remedy this defect by the addition of wood ashes; the rationale of which is as follow: The carbonated alkali of the ashes and the calcareous nitrate of the soil mutually decompose each other, and carbonated lime and nitrated potash is the result. The soil being dug up is mixed with about one-fifth by measure of wood ashes, and lixiviated in perforated casks in the usual way: the liquor thus produced, when concentrated by repeated lixiviations, is mixed with the mother water of a preceding crystallization, and boiled down for 24 hours, removing from time to time the common salt and muriated potash that separated during the process: it is now transferred while hot into shallow coolers, in order to crystallize, which it does in 24 hours more. The rough

crystals being drained, are again dissolved in water, and the product of the second crystallization is a nitre somewhat impure, but yet in a fit state for the market. Four hundred cubic feet of the mixture of earth and wood ashes afford 42 lbs. of nitre of the first crystallization, which, by the subsequent refining, is reduced to 39 lbs.

At the commencement of the French revolution, the demand for saltpetre in the gunpowder manufactory was prodigious, while all the requisite nitre was obliged to be drawn from domestic supplies. To meet this exigency, the knowledge and personal superintendance of the ablest chemists of Paris was directed to this important object; and in the space of a very few years the produce of nitre was more than quadrupled, and a simplicity and expedition introduced into the refineries of this salt, that seem to have brought its manufacture nearly to perfection.

It remains to give an account of the extraction of nitre from the earths in which it is contained, and of the purification of this salt.

The first thing to be done is to assay the earth. This is done by lixiviating a few pounds of it, and adding to the liquor thus obtained as much of a solution of common potash of a known strength, as is sufficient to decompose all the earthy salts. From this assay, the quantity of alkali required is easily calculated.

The next process is lixiviation, which is performed in the following manner: Several cart loads of nitrous earth are mixed as accurately as possible with the requisite quantity of alkali, either in the form of wood ashes or pulverized potash. Several large casks with perforated false bottoms are then filled with the prepared earth laid on it lightly; after which, as much river water is poured in as the vessel will hold. In two or three hours the cock at the bottom of each cask is turned, and the liquor is allowed to drain out during the remainder of the day. The casks of a second series charged with earth as before, are now filled up with the first lixivium, and after standing for a few hours, the liquor thus concentrated is drawn off in the manner just described. By a similar process on the third day, a lixivium

thrice as strong as the first is obtained, which is now sufficiently concentrated to be boiled down. The contents of each series of casks are lixiviated twice more, and the weak solutions thus obtained are employed instead of water in the first and second lixiviums of fresh parcels of earth.

The boiling down and evaporation next succeed. The lixivium, containing nitrate of potash, the muriates of potash and soda, with probably a few other salts, and various earthy impurities, is put into a large boiler like a salt-pan, and heated nearly to ebullition: it is then clarified by the addition of bullock's blood, or a solution of glue, the impurities as they appear on the surface being carefully skimmed off: when no more froth rises of itself a little lime-water is added, which coagulates the remainder of the blood and glue, and thus completes the clarification. It is now boiled for several hours, and the muriates of potash and soda as they deposit are withdrawn by a perforated ladle. When the liquor is so concentrated that a few drops crystallize readily on being dropped on a cold iron, it is laded out into a vat, where it remains half an hour to deposit the common salt and impurities still floating in it; hence it is transferred to large wooden or metallic crystallizing basons, where it remains close covered up during from three to six days, according to the temperature of the air. At the expiration of this period, the mother water is poured out and returned to the nitre bed, and the salt deposited in a confused crystalline mass of an opaque dirty white, is broken to pieces and set to drain, after which it is brought to market, or delivered into the government stores, as rough nitre or nitre of the first boiling.

To refine rough nitre according to the new and improved French method:

The rough nitre is broken to small fragments by wooden mallets, and is then put into a wooden tub with twenty per cent. by weight of cold water; in this state it remains for six or seven hours, being occasionally well stirred up, that the water may have free access to every part. The water is now let out by a hole at the bottom of the vessel, and carries with it in solution

all the deliquescent salts, and the greatest part of the muriates of soda and potash, together with some nitre. When the whole of the liquor is drained off, ten *per cent.* more of water is added, and well mixed with the nitre for an hour's time, when it is discharged in the same manner as the first. Lastly, five *per cent.* of water is poured in, and run off again almost immediately after. The petre thus washed, after being well drained, is put into a boiler with half its weight of water, and boiled till a pellicle forms on its surface; the liquor is then discharged into a large leaden cooler, and stirred about with rakes, till it is quite cold, by which manipulation the salt is deposited in small crystalline needles. It is now taken out of the liquor with a perforated ladle, and well drained; after which it is washed with five per cent. of cold water, and again drained: being then spread out on a large table, it dries in a few hours, and is lastly heated over the fire in large basons for two or three hours, at a temperature not exceeding 120° Fahr., taking care to stir it all the while; by this treatment it is perfectly purified and brought to the consistence of fine sand, and is now ready to be manufactured into gunpowder.

TO FIND THE SPECIFIC GRAVITY OF ANY FLUID, BY MEANS OF A SMALL VIAL AND A PAIR OF SCALES.

Communicated by Robert Patterson, Professor of Natural Philosophy and Mathematics, in the University of Pennsylvania.

METHOD FIRST.

HAVING provided a small glass vial, with a ground glass stopper, and a pair of small accurate scales, such as a pair of money-scales—

1. Weigh the glass vial with its stopper, while clean and dry, in the open air, and mark the weight.

2. Fill the vial with rain or distilled water, reduced to any standard-temperature, say 60° Far., and put in the stopper under water, so as effectually to exclude any air-bubble that might otherwise lodge between the water and the stopper.

3. Wipe the outside of the vial dry, and find the weight of the whole, from which subtracting the weight of the empty vial, there will remain the neat weight of the water. This being found, the process need never again be repeated.

4. Pour out the water, and having with a little cotton, or the like, carefully dried the vial, fill it with the fluid of which you wish to find the specific gravity, and using the same precautions as before, find the weight of the vial with its contents, from which subtracting the weight of the vial before found, there will remain the neat weight of the given fluid.

5. Divide the weight of the given fluid by that of the standard water, found as above, and the quotient will be the specific gravity,—that of water being unity.

METHOD SECOND.

1. Provide, as before, a small glass vial, with a ground glass stopper, and put into it as much mercury, shot, or sand, as will be sufficient to sink it in water, or in any other fluid on which you may make experiments.

2. The glass stopper being carefully put in, and the outside of the vial wiped dry, weigh it both in the open air, and in standard-water: which process need never again be repeated.

3. Weigh this vial with its ballast in the fluid, whose specific gravity you would find.

4. From the weight of the vial in air, subtract its weight in water for a divisor; and from the same weight of the vial in air, subtract its weight in the given fluid, for a dividend; then the quotient of this division, will be the specific gravity required.

☞ In order to weigh the vial in water, or any other fluid, you may pass a horse-hair through a small perforation made in the bottom of one of the scales, and fastening it round the neck of the vial, you may then weigh it suspended in a tumbler of the given fluid.

The first of the above methods of finding the specific gravity of a fluid, is, perhaps, generally to be preferred. R. P.

ACCOUNT OF MR. LESLIE'S EXPERIMENTS IN FREEZIEG WATER AND MERCURY, UNDER AN EXHAUSTED RECEIVER.

Communicated by a friend to the Editor.

PROFESSOR Leslie, of Edinburgh, having in the course of a train of experiments on the relation of air and moisture, found that the cold produced by the evaporation of water, depends merely on the dryness of the air independently of any other circumstance, that air is rendered much drier by rarefaction, and having also remarked the strong and durable power of sulphuric acid in attracting water from the air, he determined to try the combined operation of these powers in the freezing of water. Sulphuric acid, in a saucer, was accordingly placed on the plate of the air pump, and about two inches above it a narrower dish of water, and a double case of tin below: he then exhausted the receiver, and so violent was the cold produced from the rapid evaporation, that the congelation began in about a quarter of an hour. Nothing can exceed the beauty of the spiculæ of ice shooting over the surface. After the freezing is over, the ice never returns again under the receiver to the form of water, but remains as ice, till the whole, after some days, has disappeared. All this time, the acid is warmer in proportion to the coldness of the ice, and yet the power of the acid was not sensibly diminished, until after a considerable time. Cakes of ice, six inches broad and three-fourths of an inch thick, were frozen in July; and by enlarging the apparatus, the effects would be much greater.

The following account of the application of Mr. Leslie's process, is given in Tilloch's Philosophical Magazine (London) for March, 1812.

The experiments of professor Leslie to produce ice by evaporation in the air-pump, have been varied and extended in France by Messrs. Clement and Desormes: they have proposed to apply the evaporation, in vacuo, on a large scale, to the drying of gunpowder; which, being done without fire, will be attended with no danger.

The French chemists are engaged in endeavouring to apply

the evaporation in vacuo also to the drying and preserving fruit and vegetables. It may be easily conceived of what advantage this process may be, particularly in the army and navy, by preserving unchanged, alimentary substances, and also by diminishing their weight and bulk, when they are to be sent to distant parts of the world.

Mr. Leslie proposes to introduce the apparatus into hospitals in sultry climates, and to various domestic purposes; among others, to coolers, so as to produce ice in large quantities.

From Tilloch's Philosophical Magazine, for April 1812.

Professor Leslie has succeeded in freezing quicksilver by his frigorific process. This remarkable experiment was performed in the shop of Mr. Adie, optician, with an air-pump of a new and improved construction. A wide thermometer tube, with a large bulb, was filled with mercury, and attached to a rod passing through a collar of leather, from the top of a cylindrical receiver. This receiver, which was seven inches wide, covered a deep flat bason of nearly the same width, and containing sulphuric acid, in the midst of which was placed an egg-cup half full of water. The inclosed air being reduced by the working of the pump to the 50th part, the bulb was repeatedly dipt in the water, and again exposed to evaporation, till it became incrusted with a coat of ice about the 20th of an inch thick. The cup, with its water still unfrozen, was then removed, and the apparatus replaced, the coated bulb being pushed down to less than an inch from the surface of the sulphuric acid. On exhausting the receiver again, and continuing the operation, the icy crust at length started into divided fissures, owing probably to its being more contracted by the intense cold, than the glass which it invested; and the mercury having gradually descended in the thermometer, till it reached the point of coagelation, suddenly sunk almost into the bulb, the gage standing at the 20th of an inch, and the included air being thus rarified about 600 times. After a few minutes, the apparatus being removed, and the bulb broken, the quicksilver appeared a solid mass, which bore the

stroke of a hammer. The temperature of the apartment was then 54° of Fahrenheit.

In another experiment, with a small spirit of wine thermometer, under the same circumstances, and the same degree of rarefaction, the cold produced was found to be 70½° below nothing, or more than 30° below the point usually assigned for the congelation of mercury.

Such a prodigious power of refrigeration, and which will no doubt be further improved, opens a wide field for philosophical investigation. Liquids which have hitherto resisted coagelation may yet be rendered solid, and gases converted into liquids.

From the following extract, it will appear, that in the application of the principle of Mr. Leslie, by the French, they have long since been anticipated. It is taken from page 8 of the Appendix to the "*Mill-wright and Miller's Guide*," by Oliver Evans, published in Philadelphia in 1795, containing "Rules for discovering new improvements."

"EXAMPLE EIGHTH.

"Take the art of preserving fruits, liquors, &c. from putrefaction and fermentation. Step 1. What are the principles of putrefaction and fermentation? By experiments with the air-pump, it has been discovered that apples, cherries, &c. put in a tight vessel, having the air pumped out, will keep their natural fresh bloom for a long time. Again, by repeated experiments, it is proved, that things frozen will neither putrefy nor ferment while in that state. Hence he may conclude that air and heat are the principles or moving causes of putrefactive fermentation.

II. What plans in theory are most likely to succeed? By removing the causes we may expect to avoid the effect.

1. Suppose a cistern in a cellar on the side of a hill, and supplied by a spring of cold water running in at the top, that can be drawn off at the bottom at pleasure. If apples, &c. be put in tight vessels, and the air pumped out, and beer, cyder, &c. be put in this cistern, and immersed in water, will they putrefy or

ferment? May not the experiment succeed in an ice-house, and fruits be conveyed from one country to another in glass or metal vessels made for the purpose, with the air pumped out and hermetically sealed? In support of this hypothesis, a neighbour told me, he filled a rum-hogshead in the autumn with apples, at the bung; bunged it tight, and in the spring found them all sound. Another: when a boy, I buried a hollow gum bee-hive full of apples, trampled the earth tight about them, opened them when the wheat began to ripen, and found them all sound; but leaving them, I returned in a day or two, and found them all rotten.

STEAM BOAT CONTROVERSY.

THE question on appeal, between Messrs. Livingston and Fulton, and a combination at Albany relative to the exclusive right of the appellants to run steam boats on the waters that were within the jurisdiction, and were the property of the state of New York, having been determined in favour of the appellants by the unanimous vote of the court of appeals in that state; a short account of the controversy may be interesting to those who wish to encourage talents and enterprize. It is communicated by an eminent legal character, in New York, at the request of the Editor.

By the laws of the state of New York, a contract was entered into by that state, with Robert R. Livingston, Esq. for the building of steam boats. The laws recited that the state, in consideration of the advantages that would result to it from this enterprize, if successful, and the expense, and hazard, with which the experiments would be attended, grant to the said Robert R. Livingston, Esq. the exclusive right to navigate the waters of the state for twenty years with boats moved by steam or fire, upon condition that the said Robert should build a boat that should not be less than twenty tons burden, that should go four miles an hour; and should keep such boat in constant operation on Hudson's river. Mr. Livingston in pursuance of the law

built in the year 1800, a boat; but from the small size and imperfection of the engine he used, and perhaps from a defect in his plan (which was a horizontal wheel receiving the water at its centre, and propelling it by the centrifugal force from the stern) the boat went but little more than three miles an hour. As this was not a compliance with his contract, he founded no claim upon it: but broke up his boat and sold the engine, sustaining a loss of about $ 8000. Being shortly after sent as minister plenipotentiary to France, he, in conjunction with Mr. Fulton, whom he met at Paris, tried a variety of experiments on the different modes of propelling a boat by steam, and was convinced by them of the expediency of preferring that suggested by Mr. Fulton, and was in use in the state of New York. That nothing might be wanting to reduce their principles to practice, they built a large boat on the Seine, upon which they expended $ 8000, beyond what the materials sold for when taken to pieces. Encouraged by this experiment, they obtained from the state of New York, a law renewing their former contract, and extending it to Robert R. Livingston and Robert Fulton. In pursuance of this encouragement, they built three large vessels, the united tonnage of which amounted to upwards of 800 tons, (besides others built under their patent, and upon their models)and finished, furnished, and navigated them in such a style of expense and elegance, as renders the mode of travelling in them unequalled by any that Europe can boast of. We have been credibly informed, that they have expended on those boats and on one on the Ohio, and previous experiments, upwards of $ 150,000. Three years after these, or some of them were in operation, when every difficulty was removed and they began to reap some remuneration for their bold and expensive enterprize, a number of wealthy persons in Albany, (about 24) by no means distinguished for mechanical talents, combined to make two boats upon the model of the patentees, with very trifling variations to colour their usurpation, and actually built such boats, and run them the last summer (1811) in competition with the boats of Messrs. Livingston & Fulton. These gentlemen brought suits against the intruders,

and applied to the court of chancery for injunction to stop their boats; this the chancellor refused to grant. From the chancellor's decree, they appealed to the court for the trial of impeachments and the correction of errors; which is the highest court of judicature in the state of New York; and is composed, in case of appeals, of the five judges of the supreme court, and members of the senate, many of whom are always professional lawyers.

The ground taken by the defendants was, 1st, that congress having a right to grant patents, the state had no right to make any contract which might interfere with that right.

2d. That congress having a right to regulate trade, the waters of the state were subject to their control, and no exclusive privilege would be granted upon them.

3d. That an injunction should not issue till the right was tried at law.

The appellants insisted, first, That congress had no power but to *secure* to inventors the right to *their* invention. That the right must therefore be such as could and did exist before it was secured. That no right ever existed or could exist in inventors to control that of a state to prohibit the use of an invention that they might find injurious, or to encourage enterprize by exclusive privileges. That these powers were of the essence of every independent government; and as congress could not give exclusive privileges, the right to give them must rest in the state. That the most dangerous consequences would result from a contrary doctrine.—It was asked, cannot the legislature of Carolina prohibit the sale of a book upon the right of slaves to recover their liberty by force, or could they not give an exclusive right to one who imported, though he was not the inventor of a useful machine? and that as no power exists in congress to do these acts, such power must reside in the state. It was alleged that every power vested in congress not in its nature exclusive, or prohibited to the states, might be exercised by them in concurrence with congress. That the *securing* a natural right, had nothing exclusive in its nature, and might therefore be increased

by any state within their jurisdiction. That the whole power of congress went to prevent one man from using the mental property of another; but not to change the nature of that property, which, like all other, must be held subject to the laws of the state. That in New York, the right to navigate by steam, having been vested in Mr. Livingston, previously to any patent for such object, no natural right could exist in any inventor to exercise his invention within that state, if it interfered with Mr. Livingston's right. That the defendant had not even a patent, but merely copied the boats of the appellants, without setting up a claim to invention.

As to the second head, they showed, that though congress might have a right to regulate trade between foreign nations and different states, the constitution gave them no right to interfere in the internal concerns of the states. That turnpike roads, toll-bridges, ferries, stages, &c. were all granted by every state in the union. That the state had even a right to regulate, and actually did regulate trade every day, even with foreign nations, and the respective states; their power in that, being concurrent with congress, except so far as that they could not regulate by treaties, or the imposition of duties. That there was not a word in the constitution that gave congress a jurisdiction over the waters of a state. That on the contrary, congress had themselves, by a variety of laws, recognised the absolute jurisdiction of the states, and even their right, by their quarantine laws, to prohibit the entry of foreign vessels into any of their ports. That the mere apprehension, that the exercise of a power by a state might interfere with a right of congress, can be no objection to it, because when it actually interferes it must give way, but not till then. As to the third point, they showed that it was the invariable practice of the courts in England, to grant injunction wherever a right was founded, like that of the appellants, upon act of parliament, and that there was not a *single* case to be found in contradiction to this rule. That the defendants were likewise entitled to an injunction on the ground of their having been in quiet possession for some years.

The cause was very ably argued on both sides for five days, when, after taking time to consider, the judges gave their opinion in writing, on all the points, in very luminous arguments, in which some of them noticed with great force, the injustice of the attempts of the defendants to avail themselves of the hazard and enterprise of the appellants, and the effect that such conduct might have on the morals of the people, if it did not meet with the indignant frowns of the court.

The other members of the court concurred unanimously with the Judges in reversing the Chancellor's order, and confirming the right of the appellants to navigate the waters of the state by steam or fire exclusively, directing the Chancellor to issue an injunction to continue it till the final hearing of the cause, and then, unless new matter appears, to render it perpetual during the continuance of their exclusive privileges.

A LIST OF THE NAMES OF PERSONS TO WHOM PATENTS HAVE BEEN ISSUED FROM THE TWENTY-EIGHTH OF DECEMBER, 1810, TO THE FIRST OF JANUARY, 1812.*

THE ingenious men of our country, are invited to use this work as the vehicle for announcing their improvements or discoveries; or to give to the world their useful speculations and projects; and artists and manufacturers to make known their wants as to the imperfection of their operations or processes.

Inventions in 1811.

Philo M. Hackley, of Herkimer county, New York, a perpetual steam still and water boiler, January 11.

James Lee, of Philadelphia, in drying fuel for glass furnaces, January 14.

* Laid before Congress January 21, 1812. The notes are by the Editor, who regrets that it is not in his power to give more information respecting the patents.

Joshua Witherle, of Boston, improved cocks or locks for the passage of fluids, January 16.

Phares Bernard and Timothy Soper, of Whitestown, Oneida county, New York, a steam pump, January 16.

Phares Bernard, of do., a water boiler and steam still,(a) January 16.

Michael Morrison, of Boston, a chain float steam boat, January 17.

Augustus Day, of Bordentown, New Jersey, improvement in the sleigh,(b) January 19.

Do. of do., a new power by means of combustion, or combustion and explosion,(c) January 19.

John P. Swain, of Roxbury, Norfolk, Massachusetts, in co-operating frictionless cylinders, January 24.

Henry Steward, of Clark county, Indiana territory, an expanding and folding wheel, January 24.

Nathanial Burley, of Strafford, New-Hampshire, a vat for facilitating and cheapening the tanning of leather and colouring cloth, January 24.

Joseph Beach, of Northfield, Hampshire county, Massachusetts, in the churn, January 24.

(a) This is in operation; the advantages of it are said to be "trifling expense of construction, a saving of one half the labour, and the production of more liquor from the same quantity of grain, and of a superior quality," than from other modes of distilling.

(b) The Traineau-car, or Chariot Sleigh, is compounded of the carriage and sleigh, so as to use either as circumstances may suit. The running-geer is made precisely similar to that of a coachee, only the wheels are much smaller in the sleigh. When it is used as a sleigh, the runners extend under the rim of the wheels, and are secured to them by means of bolts passing up through the felloes, and confined by nuts and screws. If the snow leaves a person on a journey, the runners are unshipped and placed in rests at the sides of the sleigh, with the curved part turning up behind, which gives them the appearance of springs. The runners are shipped and unshipped with the greatest facility.

(c) The power gained by this machine is considerable in the small model, and it is intended to try the effect of the principle upon a large scale.

David Jewett, of Pittsfield, Massachusetts, in distilling essential oil and spirits, January 24.

John P. Swain and Thomas B. Wait, of Roxbury, Norfolk, Massachusetts, a cylindrical printing press, January 28.

Archibald Binny, of Philadelphia, improved printers' type mould,*(d)* February 4.

Stephen Chandler, of New York, in making rims to ladies' and taylors' thimbles, without soldering them, February 4.

Borden Wilbor and Timothy Soper, of Washington county, New York, in the water boiler and steam still, February 4.

Borden Wilbor, of do., in making salts by evaporation, February 4.

Archibald Binny, of Philadelphia, for smoothing or rubbing printers' types,*(d)* February 4.

Stephen Chandler, of New York, in making rims to ladies' and taylors' thimbles, without soldering them, February 4.

Volkert Vedder, of Amsterdam, Montgomery county, New York, in forming, heating, removing, and using metal plates in pressing woollen cloths, February 6.

Robert Hancock, sen. and Edward W. Carr, of Philadelphia, in the cottin gin,*(e)* February 6.

Lewis Cleveland, of Holliston, Middlesex county, Massachusetts, in the churn, February 7.

John Sanders, of Schenectady, New York, in making ardent spirits out of the juice of southern corn stalks, called the horse-tooth or Virginia corn, February 7.

John P. Swain and Jacob Skinner, of Roxbury, Norfolk county, Massachusetts, a machine for cutting nails or brads, February 8.

Robert Fulton, of New-York, for constructing boats or vessels which are to be navigated by the power of steam engines, February 9.

(d) These are part of the various improvements in type founding brought forward by Binny and Ronaldson, and now in operation.

(e) One of these gins has been sent to North Carolina, but its merits are not yet known.

(To be continued in the next number.)